

7. A Synopsis of the Tadpoles of the European Batrachians.

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(Plates XLV.-XLVII.)

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The knowledge of the larval forms of Tailless Batrachians is of no small importance to the exploring herpetologist. The presence or abundance of many a species which, from concealing or nocturnal habits, is likely to escape detection may be readily ascertained through the recognition of the tadpole. To mention a well-known example, the Midwife Toad, *Alytes obstetricans*, so common in many parts of the Continent, but so seldom met with in the daytime, betrays its existence, through its tadpole, all the year round, the breeding-time lasting throughout spring and summer, so that the tadpoles of the later broods pass the winter in that condition. The presence in a locality of any given Batrachian thus ascertained, it becomes comparatively easy, through searching under stones or in holes in the daytime, or by going about at night with a lantern, to secure specimens of the adult. Tadpoles are, as a rule, easily seen and easily caught, but the identification of the species is often a matter of difficulty. Although excellent contributions to their study have quite recently been published by Héron Royer and Van Bambeke, and by J. de Bedriaga, the absence of a concise synoptic treatment of the subject, accompanied by figures of all the European species, must have deterred many collectors from devoting to the subject the attention it deserves. During several weeks' vacation spent this summer in Brittany, I availed myself of my leisure for collecting and comparing large series of tadpoles of various species, and by incorporating the results of the researches of the above-named and other authors with my own, I have endeavoured, in the following pages, to supply the long-felt desideratum.

My object being to facilitate the determination of species on the spot, I have left out of consideration all such characters as cannot be verified by the aid of an ordinary lens. For the important characters afforded by the microscopical structure of the labial teeth, I refer the reader to the recent works of F. E. Schulze ("Ueber das Epithel der Lippen, der Mund-, Rachen- und Kiemenhöhle erwachsener Larven von *Pelobates fuscus*," Abh. Akad. Berl. 1888), H. Keiffer ("Recherches sur la structure et le développement des dents et du bec cornés chez *Alytes obstetricans*," Arch. de Biol. ix. 1888, p. 55), Héron Royer and Van Bambeke ("Le Vestibule de la bouche chez les têtards des Batraciens anoues d'Europe," Arch. de Biol. ix. 1889, p. 185), and E. Gutzéit ("Die Hornzähne der Batrachierlarven," Zeitschr. wiss. Zool. xlix. 1889, p. 43). The development of the larvæ is also left out of consideration; my descriptions apply merely to the fully-developed tadpole, in the condition generally known as the "third period" in the larval development, the period between the budding of the hind limbs and the bursting out of the fore limbs.

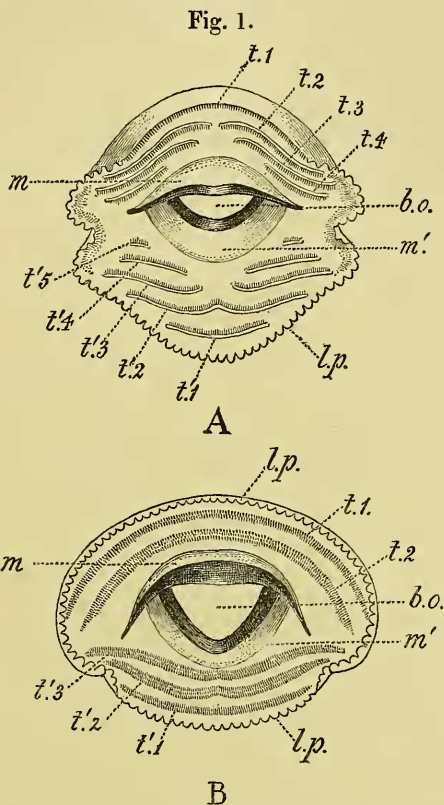
To render my synopsis perfectly intelligible, it is, however, necessary to say a few words, by way of introduction, concerning the external structure of the Tadpole and the manner in which its characters are described.

1. *The Form*.—The head and body are so fused that it is extremely difficult to discern the limit between the two. The term *body* is therefore used as meaning both head and body. Its longitudinal measurement is taken to the origin of the hind limbs. The *tail* consists of a fleshy muscular portion bordered above and below by membranous expansions, termed respectively the *upper* and *lower crest*. By depth of the tail is meant its greatest depth, crests included, and the length is measured from the posterior extremity of the body.

2. *The Mouth*.—This term is used in its wider sense, *i. e.* to include the much-developed *lip*, surrounding, like a funnel directed downwards, the *horny beak* (fig. 1, *m.*), not unlike that of a cuttlefish, which forms the entrance to the mouth proper (*b.o.*). The characters offered by this circular lip are among the most important for the distinction of species, and have formed the subject of a valuable paper by Héron Royer and Van Bambeke (Arch. de Biol. ix. 1889), to which I have already referred and shall often have to refer again. This lip may be entirely bordered by fleshy *papillæ* (*l.p.*), or these may be restricted to the sides or to the sides and the lower border. Its inner surface is furnished with ridges armed with series of minute, bristle-like, erect *horny teeth* (fig. 1, *t.*), each of which, when strongly magnified, is seen to be formed of a column of superposed cones, hollowed out at the base and capping each other; the summit of each of these cones is expanded, spatulate, hooked backwards, and usually multicuspid. By drawing an imaginary line across between the mandibles, the lip may be divided into an upper and a lower portion, the series of teeth above the upper mandible being termed *upper labial*, those below the lower mandible being *lower labial*. These are described as 1st, 2nd, 3rd, &c., proceeding from the outer border towards the beak in both the upper and the lower lip, as shown in the accompanying figures. Each series is reckoned as one, whether continuous or more or less interrupted in the middle. This method of describing appears to me far more simple, and at the same time more correct, considering the great amount of individual variation, than that used by the authors named above, who distinguish between "median" and "lateral" series according as to whether or not the series is broken up in the middle. The first series, either in the upper or lower division of the lip, may be marginal (fig. 1, A, *t.1*), or it may be within the border, which is then occupied by fleshy papillæ (fig. 1, B). I have expressed the arrangement of the series of teeth by formulæ— $\frac{2}{3}$, for instance, indicating the number in the upper and lower divisions of the lip, the figures being separated by a transverse line corresponding to the position of the horny beak. The labial teeth are usually arranged in a single row on each ridge (fig. 1, A); in the

Discoglossidæ, however, each ridge, or at any rate the second, bears two or even three rows of teeth (fig. 1, B).

The history of the accessions to our knowledge of the structure of the beak and lips has been given very fully by Héron Royer and Van Bambeke. In addition to the works of Schulze, Keiffer, and



Open mouth of, A, *Pelodytes punctatus*, B, *Alytes obstetricans*.

b.o., buccal orifice; l.p., labial papillæ; m, mandibles; t, series of labial teeth.

Gutzeit, mentioned above, I would refer the reader particularly to the following papers:—

C. VAN BAMBEKE. "Recherches sur la structure de la bouche chez les têtards des Batraciens anoures." Bull. Ac. Belg. (2) xvi. 1863, p. 339, pls. i., ii.

F. E. SCHULZE. "Ueber Cuticulare Bildungen und Verhornung von Epithelzellen bei den Wirbelthieren." Arch. f. mikr. Anat. v. 1869, p. 295, pl. xvii.

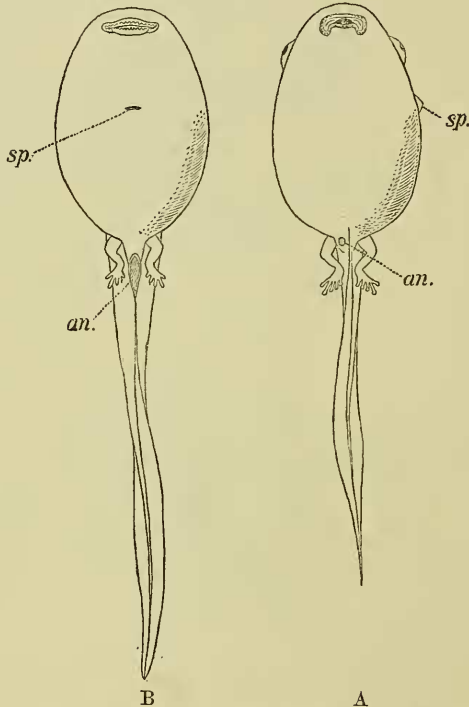
HÉRON ROYER and C. VAN BAMBEKE. "Sur les Caractères

fournis par la bouche des têtards des Batraciens anoures d'Europe." Bull. Soc. Zool. France, 1881, p. 75.

M. H. HINCKLEY. "On some differences in the Mouth Structure of Tadpoles." Proc. Boston Soc. xxi. 1882, p. 307, pl. v.

3. *The Spiraculum*.—After the disappearance of the external gills, the water is expelled from the branchial chambers by one or two tubes opening by one orifice in all European Batrachians¹. In the

Fig. 2.



Lower view of Tadpoles of A, *Hyla arborea*, B, *Alytes obstetricans*.

Discoglossidæ two tubes are present, which converge towards the mid-ventral line, where they discharge through one transverse, slit-like or crescentic opening situated in the middle of the breast (fig. 2, B, *sp.*). In all other tailless Batrachians the tube is single and opens on the left side, straight backwards in *Bufo*, backwards and upwards in the other genera (fig. 2, A, *sp.*, fig. 3, A, B). The first discovery of the median spiraculum appears to be due to Pontallié (Ann. Sc. Nat. 3, xviii. 1852, p. 250), and to Lataste

¹ There are two openings, one on each side, in the *Aglossa*.

(Actes Soc. Linn. Bord. xxxi. 1876, p. 95, and Rev. Intern. Sc. ii. 1878, p. 488) belongs the credit of realizing its full systematic importance. We are indebted to Goette (Entwick. d. Unke, p. 676, pl. xviii., 1875) and to Héron Royer (Bull. Soc. Zool. France, 1887, p. 645), who watched the process of its formation, for a correct understanding of its structure.

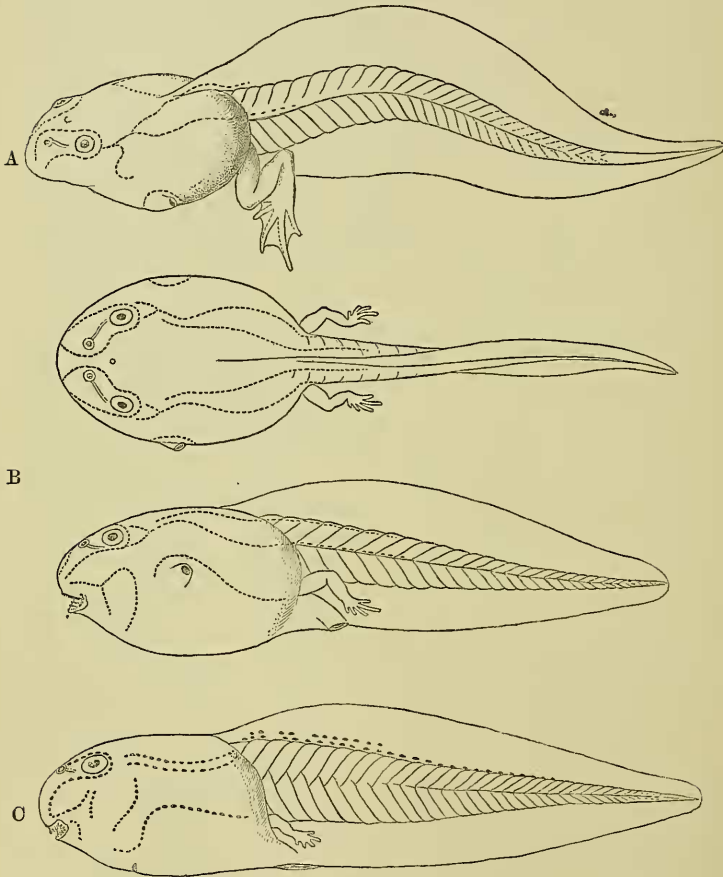
4. *The Anus.*—The anal tube is median, and opens on the middle line of the tail in tadpoles of most Batrachians (fig. 2, B, *an.*). In *Rana* and *Hyla* (fig. 2, A, *an.*), however, it is twisted to the right, opening in the former genus close to the lower edge of the lower caudal crest, higher up on the right side of the crest in the latter. It is not long since that this difference in the position of the anus was first observed. Goette (Entwick. d. Unke, p. 677, 1875) fancied that the dextral anus constantly accompanies the sinistral spiraculum, and his error has recently been repeated by Spengel (Zool. Anz. 1888, p. 339). But I showed in 1884 (Ann. & Mag. N. H. xiv. p. 390), and again in 1886 (Bull. Soc. Zool. France, 1886, p. 319), that such a correlation exists only in the genera *Rana* and *Hyla*, the Toads and Pelobatoids having the median anus together with the sinistral spiraculum.

5. *The Lines of Muciferous Crypts.*—All tadpoles are provided with these organs, the homologues of the lateral line in fishes. Their existence, long overlooked, and their signification as organs of a special sense, were first pointed out by F. E. Schulze (Arch. f. Anat. u. Phys. 1861, p. 767), whose researches into their structure were supplemented by himself (Arch. f. mikr. Anat. vi. 1870, p. 62), Leydig (N. Acta Ac. Leop.-Carol. xxxiv. 1868, p. 46), and Malbrane (Zeitschr. f. wiss. Zool. xxvi. 1875, p. 24). For further notes on the disposition of these lines we are indebted to Lessona (Atti Acc. Lincei, 3, i. 1877) and Lataste (Actes Soc. Linn. Bord. xxxii. 1879, p. 308). The latter author, however, overrated the systematic importance which is to be attached to these organs. It is a fact that they may differ greatly as regards their degree of development in individuals of the same species, and their arrangement also varies, within certain limits, irrespective of the species. I have found them usually most distinct in *Pelodytes*, *Rana agilis*, *R. latastii*, and *Bombinator igneus*, least in *Bufo*. The most distinct and constant appear to be the lines situated on the head, passing between the nostrils and bordering the eyes. I append figures (fig. 3, p. 598) of tadpoles of *Rana agilis*, *Pelodytes punctatus*, and *Alytes obstetricans*, in which these organs are represented by dotted lines. In addition to these lines all tadpoles show more or less distinctly a small whitish gland in the middle of the head between the eyes, the so-called *frontal gland* (Stieda, Arch. f. Anat. u. Phys. 1865, p. 52; Lessona, Atti Acc. Tor. v. 1880, p. 581; H. de Graaf, Bijdr. tot de Kenn. v. d. Bouw e. d. Ontwikk. d. Epiphyse b. Rept. e. Amph., Leyden, 1886), and a glandular streak, extending from the nostril towards the eye, the *lachrymal gland* (Born, Morph. Jahrb. ii. 1876, p. 611, figs. 23 & 24).

6. *Pigmentary Network.*—In addition to the ordinary pigment-

cells, the tadpoles of a few genera (*Discoglossus*, *Bombinator*, *Pelodytes*) present a system of fine black lines, most apparent on the caudal crests and the more feebly pigmented parts of the body, which afford excellent characters for their identification. It is a fact worthy of notice that when the end of the tail has been nibbled off,

Fig. 3.

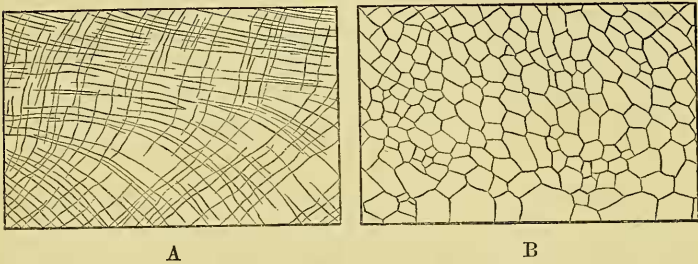


A. *Rana agilis*. B. *Pelodytes punctatus*. C. *Alytes obstetricans*.

these pigmentary lines are not reproduced on the regenerated portion. These lines were first noticed in *Bombinator* by Leydig (N. Acta Ac. Leop.-Carol. xxxiv. 1868, p. 105, pl. ii. fig. xix.), in *Discoglossus* by Lataste (Actes Soc. Linn. Bord. xxxiii. 1879, p. 304,

pl. v. fig. 7), and in *Pelodytes* by Bedriaga (Bull. Soc. Nat. Mosc. 1889, p. 541). Their aspect is shown in the following figures, representing much-enlarged pieces of the upper caudal crest of *Pelodytes* and *Discoglossus*.

Fig. 4.



Much enlarged pieces of upper caudal crest of, A, *Pelodytes punctatus*,
B, *Discoglossus pictus*.

Preservation and Manipulation.—Tadpoles should be preserved in alcohol. Chromic acid is not to be recommended, as rendering the specimens too brittle for ordinary study. To ensure the good condition of specimens preserved in spirit, it is necessary to treat them with a little care; tadpoles thrown into the ordinary collecting-bottle promiscuously with other specimens are never in a satisfactory condition for display in a collection and for future study. The best plan is to provide one's self, when going out collecting, with small test-tubes half-full of weak spirit; the tadpoles, when taken out of the fishing-net, should be dipped head foremost in the tube, which may be filled with as many specimens as it will hold. On reaching home, say two or three hours later, the liquor should be at once changed to strong spirit (40°), which will again require changing the next day, and so on until it ceases to be strongly coloured. By this method, of killing in weak spirit and then seizing by strong spirit, the tadpole preserves its natural shape in a remarkably perfect manner, and the delicate caudal crests do not shrivel. Specimens which have been only a few hours in spirit are in the best condition for study; a slight pressure of the fingers on the back and breast causes the beak and lip to gape fully, showing the arrangement of the labial papillæ and teeth. When studying specimens which have been a long time preserved, it is best to soak them for a few minutes in water, which, penetrating the subcutaneous vacuities, swells them out and restores their life-appearance. Tadpoles should never be allowed to remain out of the liquid, as they very rapidly shrink, especially the caudal crests. The lines of muciferous crypts are sometimes very difficult to trace. Héron Royer (Bull. Soc. Et.

Sc. Angers, (2) xv. 1885, p. 107) suggests as a method of ascertaining their disposition, in cases when specimens can be sacrificed, to strip the skin and spread it out on the convex surface of the bottom of a test-tube, chosen to suit the size of the tadpole; the transparent skin may then be easily studied.

G. Born (Arch. f. mikr. Anat. xxvii. 1886, p. 207) recommends a method of studying and handling the larvæ in their fresh condition, by paralyzing them through immersion in a solution of tobacco, as was proposed by Lataste for fixing the adult *in copulâ*. The little creatures become insensible after a few minutes, and remain so for about half an hour after being transferred to pure water; they recover perfectly if the immersion in the solution has not been too prolonged.

As stated above, the object of this paper is to supply comparative descriptions of the external characters of the Tadpoles of Europe, so as to facilitate the identification of the species. But in order to enable the reader to acquaint himself with the rather extensive special bibliography, I have introduced copious references to the authors who have previously dealt with the subject. I have also briefly indicated the habitat and breeding-season of each species.

In addition to the extensive material collected by myself, I have been able to study many specimens received from M. Héron Royer, M. E. Boscá, Dr. J. de Bedriaga, Prof. Born, Prof. Lütken, Dr. W. Wolterstorff, Prof. Giglioli, Dr. L. Joubin, and Prof. Camerano, to all of whom I beg to tender my sincere thanks.

The tailless Batrachians are represented in Europe by 19 species, belonging to 8 genera and 5 families:—

I. RANIDÆ.

1. RANA, L., 1766.

1. *esculenta*, L., 1766.
2. *arvalis*, Nilss., 1842.
3. *temporaria*, L., 1766.
4. *græca*, Blgr., 1891.
5. *iberica*, Blgr., 1879.
6. *latastii*, Blgr., 1879.
7. *agilis*, Thom., 1855.

II. HYLIDÆ.

2. HYLA, Laur., 1768.

8. *arborea*, L., 1766.

III. BUFONIDÆ.

3. BUFO, Laur., 1768.

9. *vulgaris*, Laur., 1768.
10. *viridis*, Laur., 1768.
11. *calamita*, Laur., 1768.

IV. PELOBATIDÆ.

4. PELOBATES, Wagl., 1830.
 12. *fuscus*, Laur., 1768.
 13. *cultripes*, Cuv., 1829.
5. PELODYTES, Fitz., 1838.
 14. *punctatus*, Daud., 1802.

V. DISCOGLOSSIDÆ.

6. DISCOGLOSSUS, Otth, 1837.
 15. *pictus*, Otth, 1837.
7. BOMBINATOR, Merr., 1820.
 16. *igneus*, Laur., 1768.
 17. *pachypus*, Fitz., 1838.
8. ALYTES, Wagl., 1830.
 18. *obstetricans*, Laur., 1768.
 19. *cisternasii*, Boscá, 1879.

It is with no small satisfaction that I look over this list and compare it with that drawn up by Schreiber ('Herpetologia Europæa') in 1875, in which only 12 species are enumerated, as showing how much progress has been made within the last fifteen years. Through the researches of Fatio, Lataste, Leydig, Héron Royer, Camerano, Pflüger, Born, Bedriaga, and myself, the right to specific rank of the forms allied to *Rana temporaria* that had been distinguished by Nilsson, Steenstrup, and Thomas has been indisputably established; the question of the distinctness of the two species of *Bombinator* has been settled; and four altogether new species have been added.

Key to the Identification of Genera and Species of European Tadpoles.

- I. Spiraculum sinistral; labial teeth disposed in a single row in each series or ridge.
- A. Anus dextral; spiraculum directed backwards and upwards; lower lip bordered with papillæ.
1. Anus opening close to the lower edge of the tail; upper caudal crest not extending forwards beyond the vertical of the spiraculum; eyes on the upper surface..... I. RANA.
 - a. Series of labial teeth $\frac{2 \text{ or } 3}{3}$.
 - Interocular space at least twice the distance between the nostrils, and much greater than the width of the mouth; tail acutely pointed, at least nearly twice as long as the body 1. *R. esculenta*.
 - Interocular space but little wider than the distance between the nostrils or the width of the mouth; tail once and two thirds to twice as long as the body 2. *R. arvalis*.
 - b. Series of labial teeth $\frac{3 \text{ to } 5}{4}$.
 - a. Tail obtusely pointed, once and a half to twice as long as the body.
- Second series of upper labial teeth widely interrupted in

- the middle; first series of lower labial teeth at least two thirds the length of the second; width of mouth a little less than the interocular width, which equals about once and a half the distance between the nostrils 3. *R. temporaria.*
- Second series of upper labial teeth continuous or narrowly interrupted; first series of lower labial teeth at least two thirds the length of the second; width of mouth quite as great as the interocular space, which equals about once and a half the distance between the nostrils..... 4. *R. græca.*
- Second series of upper labial teeth widely interrupted in the middle; first series of lower labial teeth hardly half as long as the second; width of mouth much less than the interocular space, which equals nearly twice the distance between the nostrils..... 5. *R. iberica.*
- β. Tail acutely pointed or submucronate, at least nearly twice as long as the body.
- Interocular space once and a half the width of the mouth or the distance between the nostrils; no tubercle on the upper mandible 6. *R. latastii.*
- Interocular space at least twice the width of the mouth or the distance between the nostrils; usually a black tubercle on the upper mandible 7. *R. agilis.*
- 2. Anus opening above the lower edge of the tail; upper caudal crest extending far forwards on the back, almost to between the eyes, which are lateral and visible from the ventral as well as from the dorsal aspect of the body; series of labial teeth $\frac{2}{3}$ II. HYLA.
- 8. *H. arborea.*
- B. Anus median.
- 1. Spiraculum directed straight backwards; tail rounded at the end; both upper and lower lip with toothed edge; series of labial teeth $\frac{2}{3}$ III. BUFO.
- Mouth at least as wide as the interocular space, which is twice as great as the distance between the nostrils; second upper series of labial teeth very narrowly interrupted in the middle 9. *B. vulgaris.*
- Mouth nearly as wide as the interocular space, which measures once and a half the distance between the nostrils; second upper series of labial teeth more or less interrupted in the middle 10. *B. viridis.*
- Mouth considerably narrower than the interocular space, which is nearly twice as great as the distance between the nostrils; second upper series of labial teeth very widely interrupted in the middle..... 11. *B. calamita.*
- 2. Spiraculum directed upwards and backwards; lower lip bordered with papillæ; series of labial teeth $\frac{4}{4}$ or $\frac{5}{5}$.
- a. Tail acutely pointed, without black lines; first series of upper labial teeth short; beak entirely black IV. PELOBATES.
- Tail once and a half to twice as long as the body; interocular space at least twice, often nearly thrice, the distance between the nostrils, and considerably greater than the width of the mouth 12. *P. fuscus.*
- Tail hardly once and a half the length of the body; inter-

- ocular space not more than twice as broad as the distance between the nostrils 13. *P. cultripes*.
- b.* Tail obtusely pointed, with fine black decussating lines; an inverted fold on each side of the lip, the upper edge of which bears a long series of teeth; beak white, with black edge..... V. PELODYTES.
14. *P. punctatus*.
- II. Spiraculum median; anus median; tail rounded or obtuse at the end; a papillose edge all round the lip, sometimes narrowly interrupted above; labial teeth in $\frac{2}{3}$ series, disposed in two or three rows, at least in the second series.
- A. Spiraculum equally distant from the anterior and the posterior extremity of the body; tail at least once and a half the length of the body and three and a half or four times as long as deep; caudal crests with a polygonal network of fine black lines... VI. DISCOGLOSSUS.
15. *D. pictus*.
- B. Spiraculum nearer the posterior than the anterior extremity of the body; tail not more than once and a half the length of the body, twice to twice and a half as long as deep; caudal crests with fine black decussating lines VII. BOMBINATOR.
Mouth trigonal 16. *B. igneus*.
Mouth elliptical..... 17. *B. pachypus*.
- C. Spiraculum nearer the anterior than the posterior extremity of the body; tail at least once and a half the length of the body, twice and two thirds to thrice and a half as long as deep; no black network. VIII. ALYTES.
18. *A. obstetricans*; 19. *A. cisternasi*.

With regard to size, the European tadpoles rank as follows :—

	Maximum length on record. millim.
1. <i>Pelobates fuscus</i>	175
2. „ <i>cultripes</i>	120
3. <i>Rana esculenta</i>	111
4. <i>Alytes obstetricans</i>	90
5. „ <i>cisternasi</i>	69
6. <i>Pelodytes punctatus</i>	65
7. <i>Rana agilis</i>	59
8. <i>Bombinator igneus</i>	50
9. <i>Hyla arborea</i>	49
10. <i>Rana iberica</i>	49
11. „ <i>græca</i>	48
12. „ <i>temporaria</i>	46
13. <i>Bombinator pachypus</i>	45
14. <i>Bufo viridis</i>	44
15. <i>Rana latastii</i>	44
16. „ <i>arvalis</i>	43
17. <i>Discoglossus pictus</i>	33
18. <i>Bufo vulgaris</i>	32
19. „ <i>calamita</i>	30

But if we compare the maximum length of the tadpole with the maximum length of the adult, we obtain the following order :—

	Maximum length of adult, from snout to vent. millim.
1. <i>Pelobates fuscus</i>	80
2. <i>Alytes obstetricans</i>	50
3. <i>Pelobates cultripes</i>	85
4. <i>Alytes cisternasii</i>	40
5. <i>Pelodytes punctatus</i>	45
6. <i>Bombinator igneus</i>	45
7. <i>Rana esculenta</i>	110
8. <i>Hyla arborea</i>	50
9. <i>Bombinator pachypus</i>	50
10. <i>Rana agilis</i>	75
11. „ <i>iberica</i>	50
12. „ <i>græca</i>	50?
13. „ <i>latastii</i>	65
14. „ <i>arvalis</i>	75
15. „ <i>temporaria</i>	85
16. <i>Bufo viridis</i>	85
17. <i>Discoglossus pictus</i>	70
18. <i>Bufo calamita</i>	80
19. „ <i>vulgaris</i>	150

1. RANA ESCULENTA, L. (Plate XLV. fig. 1.)

Length of body once and a half its width, or rather less, about half the length of the tail. Nostrils a little nearer the eyes than to the end of the snout. Eyes on the upper surface of the body, equidistant from the end of the snout and the spiraculum, or slightly nearer the latter; the distance between the eyes twice to twice and a half as great as that between the nostrils, and much greater than the width of the mouth. Spiraculum on the left side, directed upwards and backwards, a little nearer the end of the snout than to the anus, visible from above and from below. Anus opening on the right side, close to the lower edge of the subcaudal crest. Tail twice and three fourths to four times as long as deep, acutely pointed; upper crest convex, a little deeper than the lower, not extending far upon the back; the depth of the muscular portion, at its base, about half the greatest total depth.

Beak very broadly edged with black, sometimes almost entirely black. Sides and lower edge of the lip bordered with papillæ, which usually stand in two rows; upper lip with a long series of fine teeth, followed, on each side, by a short series; three series of teeth in the lower lip, the two outer uninterrupted, the third also continuous or narrowly interrupted, the outermost only one half to two thirds as long as the others.

The muciferous crypts are pretty distinct on the head, where they

form two series, extending from the end of the snout to the upper borders of the eyes, passing between the nostrils; a pair of dorsal lines on each side of the back, close together in front, diverging posteriorly, are usually distinguishable; these lines in the advanced tadpole coalesce to form the dorso-lateral fold of the perfect animal.

Olive or greyish olive above, speckled with brown; sides with silvery or pale golden spots; belly white; throat pinkish, with mother-of-pearl-coloured spots; tail pale greyish, closely spotted, dotted, or vermiculated with grey or blackish; the muscular portion of the tail yellowish, often with three blackish stripes on its basal third. With advancing age, when the hind limbs are approaching to their full development, the back assumes a more decidedly greenish colour, and the pale green vertebral stripe, if it is to exist, makes its appearance.

The largest tadpoles of the typical form which I collected this summer in Brittany measure 77 millim.: body 23, width of body 18; tail 64, depth of tail 20. Tadpoles of the var. *ridibunda*, sent from Prague by Hr. V. Fritsch, measure up to 90 millim. A specimen from the latter locality, 111 millim. long, is recorded by Pflüger (Arch. Ges. Physiol. xxxi. 1883, p. 141).

In addition to the admirable illustrations of Rösel (Hist. Ran. pl. xiv., 1758), this tadpole has been figured by Lataste (Actes Soc. Linn. Bord. xxx. 1876, pl. ix. figs. 4-6) and by Lessona (Atti Acc. Lincei, 3, i. 1877, pl. i. figs. 1, 4, 5), and the mouth by Héron Royer and Van Bambeke (*l. c.* pl. xv. fig. 5).

I am not aware of any differences by which to distinguish in the larval state the various races I have lately endeavoured to diagnose (Proc. Zool. Soc. 1891, p. 374).

With the exception of the extreme north, the Edible Frog inhabits the whole of the Palæartic region.

The breeding-season falls between the middle of May and the end of June, the transformation of the larvæ taking place normally from the middle of August to the end of September. Hibernating larvæ are, however, not of very unfrequent occurrence. I have more than once found in Belgium full-grown larvæ so early in the year that they must have passed the winter. Well authenticated cases of hibernation have been recorded by Kolazy (Verh. zool.-bot. Ges. Wien, xxi. 1871, pp. 38, 1267), Kessler (Bull. Soc. Nat. Mosc. 1878, p. 207), and Kollmann (Verh. nat. Ges. Basel, vii. 1883, p. 387¹).

2. *RANA ARVALIS*, Nilss. (Plate XLV. fig. 2.)

Although this species is closely allied to *R. temporaria*, it approaches in some respects *R. esculenta*, the spermatozoa, for instance, agreeing very closely with those of the latter species (*cf.* Leydig, An. Batr. Deutsch. Faun. p. 137, pl. v., 1877). The tadpole likewise is

¹ Lataste remarks, however (C. R. Assoc. Franç. xii. 1883, p. 570), that Kollmann has mixed up larvæ of *Pelobates fuscus* and *Rana esculenta* under the latter name. His largest specimen (105 millim. long) is stated to belong to *Pelobates*.

intermediate between those of the two above-named species. In its labial dentition it agrees with *R. esculenta*, the series of teeth being usually $\frac{2}{3}$, sometimes $\frac{3}{3}$ when a third very short series is present on each side of the upper lip. The beak is whitish, narrowly edged with black. Interocular space about once and a half the distance between the nostrils, which equals or slightly exceeds the width of the mouth. Tail pointed, rarely somewhat obtuse, once and two thirds to twice the length of the body, its depth about one third its length; depth of the muscular part not quite half the greatest total depth. Lines of muciferous crypts distinct on the head and body, disposed as in *R. agilis* (see fig. 3, A, p. 598).

Brown above, with metallic spots; caudal crests greyish white, with small brown spots and golden dots on the anterior half of the upper crest; sometimes a series of large brown spots on the upper edge of the tail, or a linear series of small golden spots along the upper and lower crests; belly greyish with golden dots.

The largest of the numerous specimens examined, for which I am indebted to the kindness of Prof. G. Born, M. Héron Royer, and Dr. Wolterstorff, measures 43 millim.: body 16, width of body 10; tail 27, depth of tail 9.

This tadpole has been described by Born (Arch. f. mikr. Anat. xxvii. 1886, p. 207), Héron Royer and Van Bambeke (*l. c.* p. 263, pl. xviii. fig. 1), and Bedriaga (Bull. Soc. Nat. Mosc. 1889, p. 313), but, with the exception of the mouth, has not yet been figured.

R. arvalis is known to inhabit Germany, Holland near Apeldoorn, Switzerland near Basle, Denmark, Sweden, Southern Norway, Russia, Hungary, Transylvania¹, Asia Minor, Western Siberia, the Kirghiz Steppes, and North-western Persia.

In Germany, *R. arvalis* breeds, as a rule, about a fortnight later than *R. temporaria*, and its larvæ transform between the middle of June and the beginning of August.

3. RANA TEMPORARIA, L. (Plate XLV. fig. 3.)

Length of body once and a half to once and two thirds its width, two thirds to one half the length of the tail. Nostrils equally distant from the eyes and from the end of the snout or a little nearer the latter. Eyes on the upper surface of the body, a little nearer the end of the snout than to the spiraculum; the distance between the eyes about once and a half the distance between the nostrils, and a little greater than the width of the mouth. Spiraculum directed backwards and slightly upwards, nearly equally distant from the end of the snout and from the anus, visible from above and from below. Anus opening on the right side, close to the lower edge of the subcaudal crest. Tail three to four times as long as deep, ending in an obtuse point; upper crest convex, not or but slightly deeper than the lower, not extending far upon the back; the depth

¹ I am able to add a new European locality to the habitat of this species; a breeding male obtained at Karlovac, Sclavonia, was presented this spring to the British Museum by Hr. V. Fritsch.

of the muscular portion, at its base, about one third the greatest total depth.

Beak broadly edged with black. Sides and lower edge of the lip bordered with papillæ; upper lip with a long series of teeth, followed on each side by two or three series, which are widely separated from their fellows on the other side and gradually decrease in length; four series of teeth in the lower lip, the fourth or inner widely interrupted in the middle, the first or outer at least two thirds the length of the second. Héron Royer (Bull. Ac. Belg. 3, i. 1881, p. 139) regards the specimens with three series of teeth in the upper lip as representing a distinct subspecies (*honorati*, H. R.), but Born (Arch. f. mikr. Anat. xxvii. 1886, p. 209) and Camerano (Atti Acc. Torin. xxvi. 1890, p. 82) have shown that specimens with three or four series are found promiscuously in Germany and in the Alps. I may add that British specimens have usually only three series of upper labial teeth.

Muciferous crypts very indistinct.

Dark brown to blackish above, with metallic dots; caudal crests greyish, uniform, or dotted or powdered with brown, with or without small golden spots; belly grey to blackish with metallic dots or spots.

The largest specimen from the environs of London measures 37 millim.: body 13, width of body 9; tail 24, depth of tail 7. Camerano (*l. c.*) records specimens 46 millim. long.

Rana temporaria inhabits Central and Northern Europe (where it is still found in abundance as far as the North Cape and Lapland¹), the Pyrenees, the hills of North-western Spain, and the Italian Alps, Siberia and Yesso.

It breeds, in the plains of Central Europe, from the beginning of February to the beginning of April, and the young leave the water in May or June. In the Alps, where this species is found as high up as 10,000 feet, the metamorphosis may not be completed until late in the summer, and cases of hibernation in the larval condition are frequent (Camerano, Atti Acc. Torin. xix. 1883, p. 86, and Boll. Mus. Torin. 1887, no. 30, and 1889, no. 56).

4. RANA GRÆCA, Blgr. (Plate XLV. fig. 4.)

This tadpole, although more nearly resembling that of *R. temporaria* than any other European species, differs from all its congeners in having the mouth quite as wide as the interorbital space, which equals once and a half the distance between the nostrils. The labial dentition is more developed even than in *R. temporaria*, the teeth

¹ A note by Gaimard (Bibl. Univ. 2, xxvi. 1840, p. 207) has been interpreted by some authors as indicating the presence of Frogs in Iceland. Gaimard states that he made experiments in Iceland on the endurance of cold on three Batrachians, viz. *Rana temporaria*, *Bufo vulgaris*, and *Bufo calamita*, but does not actually say that he procured the specimens on that island, although, from the wording of his note, it would be quite natural to infer he did. But neither the list of Iceland animals given by Mohr (Fors. Isl. Naturh., Copenhagen, 1786) nor that published by E. Robert in Gaimard's Voyage (Voy. en Islande et au Groënland, Zool. et Méd., Paris, 1851) contains any allusion to Batrachians.

forming $\frac{5}{4}$ or $\frac{4}{4}$ series, of which the second upper is but narrowly interrupted in the middle; the four lower series are either all continuous and occupying nearly the whole width of the lip, or the fourth is broken up in the middle. A single series of papillæ on the lower labial edge. Tail obtuse, once and two thirds the length of the body, its depth about one third its length.

Grey above, closely speckled with black, whitish beneath; muscular portion of the tail reticulated with black; caudal crests with small black spots or arborescent markings.

Total length 48 millim.: body 18, width of body 12; tail 30, depth of tail 10.

Several tadpoles, from the Parnassos, were received from Dr. Krüper. In recently describing this Frog (Ann. & Mag. N. H. 6, viii. 1891, p. 346, with fig.), I have explained how the study of these larvæ led me to suspect the existence of a new species of *Rana* in the mountains of Greece (Parnassos and Korax).

5. RANA IBERICA, Blgr. (Plate XLV. fig. 5.)

Like the following, this Frog is intermediate between *R. temporaria* and *R. agilis* in both its perfect and larval state. Width of mouth much less than the interocular space, which equals nearly twice the distance between the nostrils. Series of labial teeth $\frac{3}{4}$ rarely $\frac{4}{4}$, the second upper series widely interrupted in the middle, the third very short; first lower series short, hardly half the length of the second, fourth interrupted in the middle. The beak resembles that of *R. agilis* and, in one of the four specimens before me, the upper mandible is likewise provided with a large black tubercle in the middle of its basal portion.

Tail obtuse, once and a half to once and three fourths the length of the body, its depth about one third its length.

Lines of muciferous crypts very distinct, as in *R. agilis*.

The colour of the upper parts varies from reddish brown (Héron Royer) to blackish brown (Bedriaga); belly greyish or whitish; caudal crests brownish, the upper darker than the lower, with brown dots and large blackish spots, which are also present on the muscular part.

The largest of the two tadpoles from Coimbra, which I owe to the kindness of Dr. de Bedriaga, measures 49 millim.: body 17, width of body 12; tail 32, depth of tail 11.

The tadpole of this species, which inhabits Spain and Portugal, has recently been described by Héron Royer and Van Bambeke (*l. c.* p. 258, pl. xvi. fig. 4) and by Bedriaga (*Larves des Batr. de Portug.*, Coimbra, 1891, p. 8).

According to Boscá (*Bull. Soc. Zool. France*, 1880, p. 259), *R. iberica* is usually found in or near water. He found small larvæ on the 22nd of March and, on the same day, a breeding male.

6. RANA LATASTII, Blgr. (Plate XLV. fig. 6.)

Intermediate between *R. temporaria* and *R. agilis*. Width of

mouth equalling the distance between the nostrils and two thirds the distance between the eyes. Series of labial teeth $\frac{3}{4}$, the second upper series very widely interrupted in the middle, the third extremely short; first lower series very short, hardly half the length of the second, fourth interrupted in the middle. Beak as in *R. temporaria*. Tail acutely pointed, twice as long as the body, its depth one third its length.

Lines of muciferous crypts very distinct, as in *R. agilis*.

Brown above, whitish beneath; caudal crests whitish, dotted with dark brown, the upper with some larger spots.

Total length 44 millim.: body 14, width of body 10; tail 30, depth of tail 10.

R. latastii inhabits Northern Italy and Tuscany. Its tadpole has not been described before. I am indebted to M. Héron Royer for a single specimen, from which the above notes are taken.

7. RANA AGILIS, Thomas. (Plate XLV. fig. 7.)

In general form similar to *R. esculenta*, but snout rather shorter, the nostrils being equidistant from the eyes and the end of the snout, and spiraculum considerably nearer the posterior than the anterior extremity of the body. Interocular space twice as great as the distance between the nostrils. Tail twice to twice and a half as long as the body, pointed and attenuate or submucronate at the end, its depth about twice and two thirds in its length; upper crest very convex, deeper than the lower, and extending upon the back as far as the level of the spiraculum.

Beak broadly edged with black, usually with a black tubercle or knob in the middle of the basal part of the upper mandible, which may be accompanied by a smaller one on each side. Usually two series of papillæ bordering the lower lip. Labial teeth in $\frac{3}{4}$ series, the second and third upper short and widely separated in the middle, the first lower short, the three others nearly twice as long and uninterrupted, or the fourth very narrowly interrupted in the middle.

Very distinct lines of crypts on the head and body. One of these lines forms a hoop, the ends of which approach on the upper lip, passing above the nostrils and bordering the eye above and below; another begins behind the eye and bifurcates, the upper branch extending to the upper caudal fin, the lower to the middle of the muscular portion of the tail; a small branch may descend on each side at a short distance behind the eye, forming a sigmoid curve; another, curved line on each side, bordering the spiraculum above. (cf. fig. 3, A, p. 598).

Pale brown or rufous above, with dark brown spots; sides with roundish golden spots between a brown or reddish network; belly white, with pale golden or mother-of-pearl spots; throat pink; muscular portion of tail pale brown or yellowish, with small brown or grey spots; caudal crests greyish white, with white and small

greyish-brown spots, which are scarcer on the lower crest; usually a few deep black spots on the upper edge of the upper crest.

The largest specimen obtained by me in Brittany measures 59 millim.: body 18, width of body 12; tail 41, depth of tail 15.

The first description and figure of this tadpole were published by Lataste (*Actes Soc. Linn. Bord.* xxx. 1876, p. 430, pl. x. figs. 7-9). A better figure was given by Héron Royer (*Bull. Soc. Zool. France*, 1878, pl. iii. fig. 1). Further descriptions have since been given by Héron Royer and Van Bambeke (*l. c.* p. 255, pl. xvii. fig. 1) and by Bedriaga (*Bull. Soc. Nat. Mosc.* 1889, p. 330).

Rana agilis is now known to inhabit France, from as far north as St. Malo and Paris to the foot of the Pyrenees and the Mediterranean coast, a few localities in Western Germany (Strassburg, Linz on the Rhine, Würzburg), Switzerland, Italy and Sicily, Dalmatia, Austria as far north as Prague, Transylvania, Greece, and the Talysh district in Asia¹.

It breeds a little later than *R. temporaria*, usually, in France, between the middle of February and the beginning of April, but occasionally as late as May (Héron Royer, *Bull. Soc. Et. Sc. Angers*, xiv. 1884, p. 125), and the young usually leave the water by the end of June or beginning of July. However, this summer, near Dinard, I captured larvæ in which the fore limbs had not yet appeared as late as the 10th August. It is one of these specimens which I have figured on Plate XLV. fig. 7.

8. HYLÄ ARBOREA, L. (Plate XLVI. figs. 1-3.)

Length of body once and one third to once and a half its width, about half the length of the tail. Nostrils a little nearer the eyes than to the end of the snout. Eyes perfectly lateral, visible from above and from below, a little nearer the spiraculum than to the end of the snout; the distance between the eyes once and a half to twice as great as the distance between the nostrils, which equals the width of the mouth. Spiraculum on the left side, directed upwards and backwards, nearer the posterior than the anterior extremity of the body, not very prominent, but visible from above and from below. Anus opening on the right side, close to the body, above the lower edge of the tail. Tail once and three fourths to twice and one third the length of the body, twice to twice and a half as long as deep,

¹ A species closely resembling *R. agilis*, but the male of which is provided with internal vocal sacs, inhabits China and Japan. The British Museum has recently received several tadpoles of this species, *Rana japonica*, Blgr., obtained in the end of May of this year by Mr. Holst on Tsu-Shima, islands between Southern Japan and Corea.

These tadpoles agree with those of *R. agilis* in their labial dentition, forming $\frac{3}{4}$ series, the first lower series being about half as long as the second; all four lower series uninterrupted. Beak broadly edged with black, without tubercle. Mouth a little wider than the distance between the nostrils, which equals three fifths the width of the interocular space. Lines of muciferous crypts indistinct. Tail twice to twice and one fourth the length of the body, ending in an obtuse point, its depth three to three and a half times in its length. Caudal crests whitish, with small brown spots. Total length 39 millim.

acutely pointed, attenuate or mucronate at the end; upper crest very convex and extending far forwards on the back, almost to between the eyes; lower crest as much developed as the upper, and extending on to the belly considerably beyond the anus; the depth of the muscular portion, at its base, one third or rather less than one third the greatest total depth.

Beak broadly edged with black. Lips bordered with papillæ, which are absent in the middle of the upper border¹, and usually form two rows on the lower lip. Series of labial teeth $\frac{2}{3}$, all except the first lower occupying nearly the whole width of the lip; the second upper is narrowly interrupted in the middle, and so is sometimes the third lower; the first lower series only one third to half as long as the second.

The lines of muciferous crypts can usually be traced without much difficulty: a hoop-shaped one on each side of the head, passing above the nostril and bordering the eye above and below, both ends nearly meeting close to the upper lip, and another along each side of the body to the middle of the muscular portion of the tail.

Olive above, with golden gloss; sides with golden spots; belly white, with pearl-coloured or golden spots; muscular part of tail yellowish, with or without blackish dots and frequently with a median black line at its base; caudal crests whitish, immaculate or more or less profusely dotted and spotted with grey or blackish.

Total length of the largest specimen from Brittany 49 millim.: body 16, width of body 12; tail 33, depth of tail 15.

The Southern form, var. *meridionalis*, Boettger, regarded by some authors as a distinct species (*H. perezi*, Boscá, *H. barytonus*, Héron Royer), differs in its tadpole state, to judge by several specimens from Nice (which I owe to my friend Dr. de Bedriaga), in having the second series of upper labial teeth more broadly interrupted in the middle, and in having the muscular part of the tail bordered above and below by a black line; these two black lines together with a third running along the middle of the tail, which is immaculate or but scantily spotted, give it a peculiar appearance.

The tadpole of the common Tree-Frog has been exquisitely figured by Rösel (Hist. Ran. pl. x., 1758). Far inferior figures are to be found in the works of Lataste (Actes Soc. Linn. Bord. xxx. 1876, pl. x. figs. 4-6) and Lessona (Atti Acc. Lincei, 3, i. 1877, pl. iii. fig. 18). The best descriptions are by Lataste (*l. c.* p. 219), Héron Royer and Van Bambeke (Arch. de Biol. ix. 1889, p. 245, pl. xv. fig. 1), and Bedriaga (Bull. Soc. Nat. Moscou, 1889, p. 476).

Hyla arborea inhabits nearly the whole of the temperate parts of the Palæarctic Region, but is absent from the British Isles.

The eggs are deposited in the end of April or beginning of May, and the young are ready to leave the water from the middle of July to the end of August. A case of hibernation in the larval state has been recorded by Lessona (Atti Acc. Torin. xii. 1877, p. 322).

¹ I have never seen an uninterrupted series of papillæ on the upper lip, as figured by Héron Royer and Van Bambeke.

9. *BUFO VULGARIS*, Laur. (Plate XLVI. fig. 4.)

Length of body about once and a half its width, and three fifths to two thirds the length of the tail. Nostrils much nearer the eyes than to the end of the snout. Eyes on the upper surface; the distance between them about twice as great as the distance between the nostrils, and equal to or somewhat less than the width of the mouth. Spiraculum on the left side, directed backwards, nearly equidistant from either extremity of the body, not very prominent, but visible from above and from below. Anus median. Tail three to four times as long as deep, broadly rounded at the end; both crests nearly equal in depth, with nearly straight and parallel edges; the depth of the muscular part of the tail, at its base, two fifths the greatest total depth.

Beak white, broadly edged with black. Lips with papillæ only at the sides, which form an inward fold; both upper and lower edge toothed, the series of labial teeth being $\frac{2}{3}$; the second upper series nearly as long as the first, and very narrowly interrupted in the middle; the three lower series uninterrupted and occupying nearly the whole width of the lip.

Lines of muciferous crypts not or scarcely traceable.

Blackish brown or black above, blackish grey beneath; muscular part of tail dark brown or blackish; crests grey, finely speckled as if powdered with black.

The tadpole of this, the largest European Batrachian, is very small. The largest specimen measured by me is 32 millim. long: body 12, width of body 8; length of tail 20, depth of tail 5. The recently transformed young measures only 8 to 12 millim. from snout to vent.

Descriptions or figures of the tadpole of *Bufo vulgaris* are given by Rösel (Hist. Ran. p. 94, pl. xxi., 1758), Lataste (Actes Soc. Linn. Bord. xxx. 1876, p. 288, pl. x. figs. 10-12), Héron Royer and Van Bambeke (*l. c.* p. 291, pl. xxiii. fig. 1), and Bedriaga (Bull. Soc. Mosc. 1889, p. 362.)

The Common Toad inhabits the whole of Europe, Northern and Temperate Asia, as far east as Mantchuria, Japan, and China¹, and North-west Africa.

In Central Europe the breeding-season, which lasts only a few days, falls between the beginning of March and the middle of April, and the young leave the water between the middle of May and the end of June.

10. *BUFO VIRIDIS*, Laur. (Plate XLVI. fig. 5.)

Although nearer the latter species, *B. viridis* may be regarded as, in some respects, intermediate between *B. vulgaris* and *B. calamita*; and this view is supported by the characters of the tadpole, which

¹ A specimen was recently obtained by Mr. A. E. Pratt at an altitude of 17,000 feet in the Province of Sze Chuen. In the Alps it does not seem to extend higher up than 7000 feet.

whilst differing from both its congeners in its larger size and its broader internarial space, and approaching *B. vulgaris* in its wide mouth, varies as regards its labial dentition between the two types. Héron Royer and Van Bambeke represent the labial dentition as very similar to that of *B. calamita*; and whilst I have seen Italian specimens which agree tolerably well with the figure given by these authors, I have at the same time examined others from Breslau which would be pronounced as *B. vulgaris*, if that character alone were taken into consideration. The Italian specimens which I have examined all show the second upper labial series widely interrupted in the middle, but extending outwards nearly, or quite, as far as the first; the first lower series measures two thirds to three fourths the length of the second. The large series of specimens (about 50) from Breslau, for which I am indebted to the kindness of Prof. Born, shows every passage between the widely interrupted second upper series of teeth and one that differs in no respect from that of *B. vulgaris*; the length of the first lower series varies from one half to three fourths the length of the second.

Distance between the eyes about once and a half the distance between the nostrils, and equal to the width of the mouth. Tail three to four times as long as deep, broadly rounded at the end, its upper crest more convex than in *B. vulgaris* and a little deeper than the lower; the depth of the muscular part of the tail about half the greatest total depth.

Brown or greyish olive above, uniform or with small darker spots; belly greyish white; caudal crests greyish white, with or without small brown spots or dots.

The following are the measurements of the largest specimen, from Breslau, examined by me:—Total length 44 millim.: body 18, width of body 13; tail 26, depth of tail 9. The recently transformed young measures from 10 to 17 millim. from snout to vent.

The tadpole of *B. viridis* has been described by Héron Royer and Van Bambeke (*l. c.* p. 293, pl. xxiii. fig. 3) and by Bedriaga (*Bull. Soc. Nat. Mosc.* 1889, p. 387).

This species has a very wide geographical range. It inhabits the whole of Central and Southern Europe as far west as the Rhine and the Alps, the Balearic Islands, North Africa, and South-western and Central Asia as far east as Mongolia, Eastern Turkestan, Afghanistan, and the Himalayas. In Europe it is known to reach an altitude of nearly 6500 feet in the Alps of Savoy (R. Blanchard, *Bull. Soc. Zool. France*, 1888, p. 67); and in Asia it ascends the Himalayas to about 15,000 feet (Stoliczka, *Journ. As. Soc. Beng.* xxxix. 1870, p. 155), which is, next to the altitude of 17,000 feet reached by *Bufo vulgaris*, the highest point from which a Batrachian has ever been recorded.

The breeding-season falls between that of *B. vulgaris* and that of *B. calamita*, lasting from the beginning of April to the middle of June. Like *B. vulgaris* and unlike *B. calamita*, which is never to be found in the water except at night, the breeding individuals make a prolonged sojourn in the water.

11. *BUFO CALAMITA*, Laur. (Plate XLVI. fig. 6.)

The tadpole of the Natterjack differs from that of the Common Toad in the narrower mouth, which measures less than the interocular space and a little more than the distance between the nostrils; the somewhat more convex upper caudal crest; and the lesser length of the second series of upper labial teeth, which is very broadly interrupted in the middle.

Black above, sides and belly dark lead-grey, with pale bronzy dots; caudal crests grey, finely speckled with black; throat and chin sometimes whitish; the light vertebral line, characteristic of this species, sometimes present before the appearance of the fore limbs.

This is the smallest European tadpole, seldom reaching the length of 30 millim. recorded by Bedriaga. The following are the measurements of the largest of hundreds of specimens examined by me:—Total length 25 millim.: body 10, width of body 7; tail 15, depth of tail 5. I have seen recently transformed young measuring only 7 millim. from snout to vent.

The only figure ever given of this tadpole is that accompanying Lataste's description (*Actes Soc. Linn. Bord.* xxx. 1876, p. 297, pl. xi. figs. 1-3); the mouth is described and figured by Héron Royer and Van Bambeke (*l. c.* p. 295, pl. xxiv. fig. 1), and detailed descriptions are given by Bedriaga (*Bull. Soc. Nat. Mosc.* 1889, p. 406, and 'Larves des Batraciens de Portugal,' Coïmbra, 1891, p. 10).

The habitat of *Bufo calamita* extends from the extreme West of Europe¹ to Western Russia, the species becoming gradually scarcer or more local from West to East; it is entirely absent from Italy and South-eastern Europe.

The breeding-season lasts from the middle of April to the middle of July; it is by no means unusual to find in June and in the beginning of July, together in one and the same spot, ova, tadpoles, and recently transformed young of this species.

12. *PELOBATES FUSCUS*, Laur. (Plate XLVI. fig. 7.)

Length of body once and a half to twice its width, two thirds to one half the length of the tail. Nostrils a little nearer the eyes than to the end of the snout. Eyes on the upper surface of the body, equidistant from the end of the snout and the spiraculum, the distance between them at least twice, sometimes nearly three times as great as that between the nostrils, and considerably greater than the width of the mouth. Spiraculum on the left side², directed upwards and backwards, equidistant from either extremity of the body or a little nearer the anterior extremity, visible from above and from below. Anal opening median, a little larger than the spiraculum, and close to the body. Tail twice and a half to thrice and one

¹ From Scotland and Ireland to the South of Spain.

² Héron Royer (*Bull. Soc. Zool. France*, 1884, p. 162) has recorded two interesting teratological cases in this tadpole: one with two spiracula, the other with the spiraculum on the right side instead of the left.

fifth as long as deep, acutely pointed; upper crest convex, slightly deeper than the lower, not extending far upon the back; the depth of the muscular portion, at its base, about half the greatest total depth.

Beak black. Lip bordered with papillæ, which form two or more rows on the sides; the papillose border interrupted mesially by a narrow toothed descending lobe, which appears at first sight as continuous with the second upper series of teeth¹; this anterior series is followed by three or four other series of teeth, which are all widely interrupted in the middle and gradually decrease in length; the fourth, if at all present, being extremely short. On the lower lip we see likewise a short outer series, followed by three or four much longer ones, all of which, with the occasional exception of the first, are interrupted in the middle and may be more or less broken up on the sides. The series of labial teeth may therefore be formulated as $\frac{4}{4}$ or $\frac{5}{5}$. Small isolated teeth may also be scattered on the papillæ at the angles of the mouth.

I have not been able to distinguish lines of crypts beyond the two series which run from the end of the snout to the upper border of the eyes, passing between the nostrils. I am therefore unable to judge whether the dorsal lines have been correctly figured by Lessona (Atti Acc. Lincei, 3, i. 1877, pl. v. figs. 20 & 28), who rightly regards the figure given by Cornalia (Atti Soc. Ital. xvi. 1873, pl. iii. a.) as fanciful. From what I know of other tadpoles, I can hardly believe in the arrangement described by Lessona, especially as so great a difference from the allied *P. cultripes*, figured by Lataste (Actes Soc. Linn. Bord. xxxiii. 1879, p. 313), appears very improbable.

The advanced tadpole of *P. fuscus* is brown or olive-brown above, with or without small darker spots, greyish white beneath; sides with roundish whitish or pale golden spots; tail pale brown, with small grey and whitish spots.

The body usually reaches at least the size of a pigeon's egg, but not unfrequently exceeds that size. The largest specimen in the British Museum, from Prague, measures 125 millim.: body 38, width of body 25; tail 87, depth of tail 27. The largest specimen

¹ And is so figured by Héron Royer and Van Bambeke (Arch. de Biol. ix. 1889, pl. xix. fig. 1) as characteristic of *P. fuscus*, such as it occurs in France. But specimens from Paris, which I received from M. Héron Royer himself, show exactly the same arrangement as described and figured (*l. c.* pl. xviii. fig. 7) in *Pelobates* from Belgium, Germany, and Italy. Had the difference been a real one, M. Héron Royer might have reflected on my remarks (Bull. Soc. Zool. France, 1888, p. 115) to the effect that if there exist two distinct forms confounded under the name of *P. fuscus*, it is the French form that is to be distinguished and not the Italian, which agrees best with the typical *P. fuscus* of Germany. On reading Héron Royer and Van Bambeke's account, one might feel inclined, on the evidence of the differences shown by their figures, to accept such a distinction; but, considering that the Parisian tadpoles do not in any way differ in their labial characters from the German, as figured by F. E. Schulze and Gutzeit, nor from the specimens from Prague, Basle, and Denmark, with which I have compared them, I feel justified in regarding Héron Royer's figure (*l. c.* pl. xix. fig. 1) as incorrect.

on record is one preserved in the Berlin Museum, obtained in December 1867, on the Jungfernheide, near Berlin, and which measures 175 millim. (E. v. Martens, Sitzb. Ges. nat. Fr. Berl. 1867, p. 35).

The masterly figures given by Rösel (Hist. Ranar. pl. xviii., 1758) are still unequalled. The structure of the mouth and lips has been described and figured by Van Bambeke (Bull. Ac. Belg. 2, xvi. 1863, p. 341, pl. i.), F. E. Schulze (Abh. Ak. Berl. 1888, p. 4, pls. i.-iv.), Héron Royer and Van Bambeke (Arch. de Biol. ix. 1889, pl. xviii. fig. 7, and pl. xix. fig. 1), and Gutzeit (Zeitschr. wiss. Zool. xlix. 1889, p. 50, pl. ii. fig. 16).

Pelobates fuscus has a wide distribution, being locally distributed over Germany, Austria, Russia, Southern Sweden, Denmark, Belgium, Northern and Central France, the North-western extremity of Switzerland, Piedmont, Lombardy, and Bologna¹.

Owing to its burrowing habits, *Pelobates fuscus* is only found in localities where the soil is particularly light, and it usually chooses deep ponds for depositing its spawn. The breeding-season falls normally between the end of March and the beginning of May; but it has been observed near Ghent, in Belgium, as late as the 21st of July (Van Bambeke, in Héron Royer, Bull. Soc. Et. Sc. Angers, xv. 1885, p. 72). The larvæ usually transform in July and August; that, under special circumstances, the larvæ may hibernates, is shown by the observations of Kollmann (Rec. Zool. Suisse, i. 1883, p. 75) and Pflüger (Arch. f. Ges. Phys. xxxi. 1883, p. 134).

13. PELOBATES CULTRIPES, CIV. (Plate XLVI. fig. 8.)

Differs from the preceding in the following points:—The nostrils are wider apart, the distance between them equalling the width of the mouth, or at least one half the width of the interocular space. The series of labial teeth are more broken up, and their arrangement is therefore less easily expressed by a formula, although practically of the same type as in *P. fuscus*. According to Héron Royer, each series presents several curves; but such an arrangement is not distinctly shown by the tadpoles before me, which I owe to M. Héron Royer himself; that character is therefore not constant. The tail is shorter, hardly once and a half the length of the body. The lines of crypts are usually more distinct than in the allied species, owing to the black colour of the tubules; their arrangement has been figured by Lataste (*cf. supra*, p. 615), who at the same time observes that they are liable to no inconsiderable individual variation.

The colour is described by Lataste as reddish yellow above, greyish or bluish white beneath; tail with small brown spots.

¹ As noticed by Crivelli (Rend. Ist. Lomb. 2, vi. 1873, p. 174) and Camesano (Boll. Mus. Torin. i. 1886, no. 9), it may be seen, by referring to Spallanzani's Dissertations Nat. Hist. An. & Veget. (Engl. transl. ii. p. 122, London, 1784), that *P. fuscus* was first discovered in Italy, at Pavia, as early as 1780. The animal is described by Spallanzani in an unmistakable manner.

According to Dugès, the size of the body may equal a hen's egg. The specimens from the Dép. Hérault, preserved in the British Museum, and for which I am indebted to the kindness of M. Héron Royer, are much smaller:—Total length 62 millim. : body 25, width of body 15 ; tail 37, depth of tail 12.

Figures by Dugès (Rech. Ostéol. Myol. Batr. 1835, pl. xiii. fig. 80, and pl. add. fig. 8), Des Moulins (Actes Soc. Linn. Bord. xxix. 1874, pl. vi.), and Lataste (Actes Soc. Linn. Bord. xxx. 1876, pl. x. figs. 1-3, and xxxiii. 1879, p. 313).

Inhabits the South of France, extending on the West coast as far north as the Loire-Inférieure, Spain, and Portugal.

14. PELODYTES PUNCTATUS, Daud. (Plate XLVII. figs. 1, 2.)

Length of body rather more than once and a half its width, and not quite two thirds the length of the tail. Nostrils halfway between the end of the snout and the eyes, or a little nearer the latter. Eyes on the upper surface of the body, equidistant from the end of the snout and the spiraculum, the distance between them about twice as great as that between the nostrils, and equal to the width of the mouth. Spiraculum on the left side, directed upwards and backwards, nearly equidistant from either extremity of the body, visible from above and from below. Anal opening median, much larger than the opening of the spiraculum. Tail twice and a half to three times as long as deep, ending in an obtuse point ; the upper crest very convex, deeper than the lower, and rarely extending forwards as far as the level of the spiraculum ; the depth of the muscular portion, at its base, one third to two fifths of the greatest total depth.

Beak white, with a black margin. An inverted fold at the side of the lip ; this is furnished with a single row of papillæ except on the upper border, which is toothed. Labial teeth in $\frac{4}{4}$ or $\frac{5}{5}$ series, the second and third, both above and below, the longest ; the first and second series in both divisions of the lip uninterrupted, or the second upper with very slight median interruption, the others separated in the middle and gradually decreasing in length to the last, which, if present, is short. According to Bedriaga, there may be as many as six series of teeth on the lower lip, the first three of which are uninterrupted.

Lines of crypts usually very apparent, but sometimes very indistinct. On the head they approach each other between the nostrils and completely border the eye posteriorly, the anterior extremities of this naso-orbital hoop approaching each other above the upper lip. Of the two dorsal lines, which diverge posteriorly, the upper, extending to the upper edge of the muscular portion of the tail, is interrupted at a short distance behind the eye ; its anterior portion may even descend to join the lower line, which thus appears bifurcated in front ; the lower line extends, usually uninterrupted, from behind the eye to the middle of the muscular portion of the tail, where it is lost ; both lines, however, may stop short of the tail. A sinuous line on the flanks, curved above the spiraculum, not bent

upwards posteriorly, sometimes extending nearly to the origin of the hind limbs. In addition to these lines, a short horizontal branch originates above the upper lip, and, bifurcating below the vertical of the anterior border of the eye, forms a hoop which descends to the sides of the throat. The arrangement of these lines is figured on p. 598 of this paper.

Coloration usually varying from pale grey to olive-brown above, the sides with pale metallic spots; the lines of crypts whitish; caudal crests greyish, with blackish spots and white dots and pale metallic spots. Some specimens, however, have the tail almost spotless; in others, on the contrary, it is very closely spotted, but always less abundantly on the lower crest than on the upper. Lower parts pale grey with silvery spots. Tail and the greater part of the body with fine black decussating lines, as in *Bombinator*; it sometimes happens that these lines are altogether absent on the muscular part of the tail.

But, as in other tadpoles, coloration is subject to a great amount of variation. During a stay of seven weeks in Brittany last summer, I was much struck on finding, in the beginning of July, near St. Enogat, Ille-et-Vilaine, a small and shallow pond, about 15 feet long by 10 feet wide and 2 feet deep, swarming with thousands of tadpoles from 30 to 40 millim. long, of a very dark brown, almost black, which, although I am familiar with the larvæ of *Pelodytes*, I at first failed to recognize. It was only after a careful examination that I ascertained the species to which they belong, my determination being ultimately confirmed by the transformation of some of the tadpoles which I had brought home alive. Now several ponds close by, whether large or small, deep or shallow, of clear or of thick muddy water, all showed the ordinary type of *Pelodytes*-tadpole. I constantly visited the spot: the water, which at first was perfectly clear and transparent, became green and dirty, but the larvæ did not alter in colour or size; and I was surprised at the small size of the young immediately after transformation, which did not exceed 11 to 15 millim. from snout to vent, whilst the other places yielded young varying between 19 and 22 millim. Towards the middle of August the little pond was taken up for those linen-washing operations with which all who have visited Brittany are unpleasantly familiar, and my observations were thus terminated by the wholesale destruction of the tadpoles. But those, still numerous, which had remained up to that time had not undergone any change. As I have said above, these tadpoles were nearly black on the back; the tail was of a dark brown without any, or with but very small, black spots, and with the black decussating lines so crowded that they could not be detected without a lens; the belly was of a beautiful steel-blue, and the lines of crypts were quite indistinct, although they have become distinguishable now that the specimens have been for some time in spirit. One of these black tadpoles is figured, Plate XLVII. fig. 2.

The largest measured: body 16 millim., width of body 10; tail 24, depth of tail 8. The young were by no means melanotic,

but possessed of the usual grey, green-spotted coloration. Their small size alone distinguished them.

It is clear that the abnormal colour of these tadpoles was not due to the surroundings at the time I observed them, as the water in which they lived underwent various changes during the five weeks I watched the pool; and specimens which I brought home and kept under the same conditions as normal larvæ did not change colour. I am therefore able to confirm the conclusions arrived at by Héron Royer, from observations on larvæ of *Alytes obstetricans* (Bull. Soc. Zool. France, 1878, p. 65), that is, that the coloration is due to the conditions under which the larva develops on leaving the egg; and that after that time, the pigment-cells becoming fixed and less sensitive, little or no alteration takes place until the end of the larval period.

The largest tadpole of *Pelodytes* obtained by me in Brittany measures 57 millim.: body 21, width of body 15; tail 36, depth of tail 14. A specimen from Nice, received from Dr. de Bedriaga, measures 65 millim.

We are indebted for the first account of this tadpole to Héron Royer (Bull. Soc. Zool. France, 1878, p. 131, pl. iii.), who pointed out that the larva described and figured by Lataste as of *Pelodytes* is that of *Alytes obstetricans*. He, however, erroneously represented the lines of muciferous crypts as decussating on the forehead; and this error was soon corrected by Lataste (Actes Soc. Linn. Bord. xxxiii. 1879, p. 309). Further notes were contributed by Héron Royer (Bull. Soc. Zool. France, 1879, p. 229, pl. xi.), and by the same author in conjunction with Van Bambeke (Arch. de Biol. ix. 1889, p. 277, pl. xx. figs. 5-12). The best description is that given by Bedriaga (Bull. Soc. Nat. Mosc. 1889, p. 539), who for the first time notices the pigmentary decussating lines.

The habitat of *Pelodytes punctatus* is restricted to France, where it occurs nearly everywhere with the exception of the central Plateau and the extreme North-east, being recorded as far north as the Pas-de-Calais (Giard, Bull. Sc. Fr. Belg. xxii. 1890, p. 87), Spain and Portugal, Liguria (Doria, Ann. Mus. Genova, xxiv. 1887, p. 388), and Piedmont (Peracca, Boll. Mus. Torin. i. 1886, no. 1).

The tadpole usually lives in flooded quarries. I have found it in Brittany in company with tadpoles of *Rana esculenta*, *R. ugilis*, *Bufo calamita*, and *Hyla arborea*.

A. Thomas (Ann. Sc. Nat. 4, i. 1854, p. 290) appears to have been the first to notice, at Nantes, that *Pelodytes* breeds not only in the spring, but also in the autumn; and he assigned to this species two broods a year—the first from the end of February to the beginning of April, the second from the end of September to the beginning of October. Lataste (Actes Soc. Linn. Bord. xxix. C. R. 1874, p. cli) has witnessed its breeding, near Bordeaux, on the 22nd May, and (Actes Soc. Linn. Bord. xxxi. 1876, p. 11) near Paris on the 8th July. Thomas's statement regarding the autumnal breeding has been contested by Héron Royer (Bull. Soc. Zool. France, 1878, p. 131, and Bull. Soc. Et. Sc. Angers, 2, xv. 1885, p. 103), but is

confirmed by Bedriaga's observations at Nice, where he has found the frog pairing from the end of February to May, and again in October and November. I have myself this summer, at St. Enogat, observed specimens pairing on the 21st August. Late offspring of course hibernate in the larval condition, as ascertained by Bedriaga (Bull. Soc. Nat. Mosc. 1889, p. 542), who obtained near Nice, on the 10th March, in one and the same pond, full-grown tadpoles, spawn, and breeding individuals. Larvæ of *Pelodytes* may therefore be found all the year round.

15. *DISCOGLOSSUS PICTUS*, Otth. (Plate XLVII. fig. 3.)

Length of body once and two thirds its width, two thirds to one half the length of the tail. Eyes on the upper surface of the body, the distance between them about once and a half the distance between the nostrils, equal to or slightly less than the width of the mouth. Spiraculum in the mid-ventral line, equally distant from either extremity of the body. Anal opening median, larger than the spiraculum. Tail three to four times as long as deep, broadly rounded at the end, as in *Bufo vulgaris*, both upper and lower crests but very feebly convex, the former not extending upon the back; the depth of the muscular part at its base one half to two fifths the total depth.

Mouth elliptical. Beak white, edged with black. Lips bordered by a single series of papillæ, which are usually narrowly interrupted in the middle of the upper lip; a well-marked chink on each side of the lower lip. Series of labial teeth $\frac{2}{3}$, occupying the whole width of the lips, the third lower interrupted in the middle; the first upper and the first lower series formed of one or two rows of teeth, the others constantly of two¹. I can distinguish the ordinary lines of crypts on the head, and also one running along each side of the back.

Brown above, whitish below; caudal crests whitish, uniform or with small brown dots. The whole body and tail with a network of fine brown lines forming polygonal meshes; this network most easily traceable on the tail.

Total length 33 millim.: body 12, width of body 7; tail 21, depth of tail 6.

The tadpole of *Discoglossus* was first described and figured by Lataste in his "Étude sur le Discoglosse" (Actes Soc. Linn. Bord. xxxiii. 1879, p. 287, pl. v. figs. 1-4); and his account has been supplemented by Héron Royer (Bull. Soc. Zool. France, 1885, p. 565, pl. xiv.), Héron Royer and Van Bambeke (*l. c.* p. 280, pl. xxi. fig. 1), and Bedriaga (Bull. Soc. Nat. Mosc. 1889, p. 557).

Discoglossus pictus inhabits Spain and Portugal, Corsica, Sardinia, Sicily, Malta, and small neighbouring islands, Morocco, Algeria, and Tunisia. Its breeding-season lasts from February (in Algeria) to the end of summer.

¹ The duplex disposition of these teeth has been overlooked by Héron Royer and Van Bambeke, who state that all the teeth form single series. Such is certainly not the case in the specimens examined by me, some of which were named by M. Héron Royer himself.

16. *BOMBINATOR IGNEUS*, Laur. (Plate XLVII. fig. 4.)

Length of body once and one fourth to once and one third its width, four fifths to two thirds the length of the tail. Eyes on the upper surface of the body, the distance between them twice and a half to three times as great as that between the nostrils, equal to or slightly less than the width of the mouth. Spiraculum in the mid-ventral line, nearer the posterior than the anterior extremity of the body. Anal opening median, much larger than the spiraculum. Tail twice to twice and a half as long as deep, ending in an obtuse point; the upper crest convex, not or but slightly deeper than the lower, and extending upon the back; the depth of the muscular part, at its base, one half to two fifths the total depth.

Mouth triangular. Beak white, bordered with black. Lips bordered by a series of papillæ; a well-marked chink on each side of the lower lip; series of labial teeth $\frac{2}{3}$, occupying the whole width of the lips, all uninterrupted, or the third lower broken up in the middle; the first upper and the first lower series formed of two or three rows of teeth, the others of two, three, or four.

Well-marked series of muciferous crypts; one on each side of the head, from above the upper lip, passing above the nostril and bordering the eye, then descending towards the upper lip, where it curves and ascends to below the eyes; two series on each side of the back, beginning at some distance behind the eye, the upper extending to the upper portion of the muscular part of the tail, the lower very short and parallel to the upper; and finally a short curved series on each side of the belly.

Brown above, greyish white below; the series of muciferous crypts whitish; tail greyish, with or without small brown spots. A network of fine black lines crossing each other at right angles is spread over the whole tadpole, but most distinct on the caudal crests.

Total length 50 millim.: body 20, width of body 16; tail 30, depth of tail 15. These measurements are taken from a specimen from Denmark, received from Prof. Lütken.

This tadpole has been described and figured by Héron Royer, Bull. Soc. Zool. France, 1887, p. 647, pl. xii.

Bombinator igneus inhabits the plains of Northern and Eastern Germany¹, Denmark, Southern Sweden, Austria, Roumania, and Russia. Breeds in May and June.

17. *BOMBINATOR PACHYPUS*, Fitz. (Plate XLVII. fig. 5.)

One very striking character distinguishes this tadpole from the preceding, viz. the shape of the mouth, which is elliptical as in the other genera of *Discoglossidæ*. Otherwise, I have not been more successful than Héron Royer in discovering any constant characters by which to distinguish it. The tail is, as a rule, rather shorter,

¹ Bedriaga, in his excellent recent work on the Batrachians of Europe (*l. c.* p. 590), is mistaken in recording this species from the Lower Main district on the authority of Koch. Both Koch's var. *typus* and var. *brevipes* represent *B. pachypus*, as is perfectly clear from his allusion to the "gelbes Endglied" of the toes in the former.

and the muciferous crypts, so distinct in *B. igneus*, are hardly distinguishable in the tadpoles of this species, of which I obtained a number in the Duchy of Luxemburg. However, it is very probable that such a difference would not prove constant if tested on more extensive material.

The largest specimen collected by me measures 37 millim. : body 17, width of body 14; tail 20, depth of tail 10.

Descriptions or figures are given by Lataste (Actes Soc. Linn. Bord. xxx. 1876, p. 278, pl. ix. figs. 10-12), Héron Royer and Van Bambeke (Arch. de Biol. ix. 1889, p. 282, pl. xxi. fig. 6), and Bedriaga (Bull. Soc. Nat. Mosc. 1889, p. 573). The decussating pigmentary lines appear to have been first noticed by Leydig (N. Acta Ac. Leop.-Carol. xxxiv. 1868, p. 105, pl. ii. fig. xix., and An. Batr. D. Faun. p. 56); and Pflüger (Arch. f. Ges. Phys. xxxi. 1883, p. 139) has dwelt on the importance of this character for distinguishing this tadpole from that of *Alytes*. The classical work of Götte (Entwicklungsgeschichte der Unke, Leipzig, 1875, with atlas) is devoted to the embryology of this species.

This species, which has long been confounded with the preceding, inhabits France, Belgium, Switzerland, Western and Central Germany, Austria, Roumania, Italy, Dalmatia, Greece, and Turkey. It breeds from the latter half of May to the end of June, and the young leave the water in August or September.

18. *ALYTES OBSTETRICANS*, Laur. (Plate XLVII. figs. 6, 7.)

Length of body once and one third to once and a half its width, two thirds to one half the length of the tail. Nostrils nearly half-way between the end of the snout and the eyes. Eyes on the upper surface of the body, the distance between them about twice as great as that between the nostrils, and equal to or slightly greater than the width of the mouth. Spiraculum in the mid-ventral line, a little nearer the anterior than the posterior extremity of the body. Anal opening median, very much larger than the spiraculum. Tail twice and two thirds to thrice as long as deep, ending in an obtuse point; the upper crest convex, usually a little deeper than the lower, and extending but very slightly upon the back; the depth of the muscular portion, at its base, about half the total depth.

Beak white, with a broad black margin. Lip entirely surrounded by a series of papillæ. Labial teeth in $\frac{2}{3}$ series, occupying nearly the whole width of the inner surface of the lip, all continuous, or the third lower narrowly broken up in the middle; the first upper and the first lower series composed of one or two rows of teeth, the others composed of two or three rows.

Lines of crypts usually very indistinct, all that can be distinguished being the usual lines from the end of the snout between the nostrils, bordering the eyes above, behind, and below, and forming a hoop on each side of the upper lip, a line beginning at a considerable distance behind the eye along each side of the back to the upper border of the muscular part of the tail, and another very short line close to

and parallel with the anterior extremity of the latter. But in a fine specimen from Ballaigues, Switzerland, sent to me by my friend Dr. de Bedriaga, the lines of crypts are much more distinct and blackish ; in addition to the series described above, it shows the second dorsal line prolonged to the base of the tail, which also bears two lines, the upper being on the upper caudal crest ; a short series descends vertically from below the centre of the eye, another, curved, from below the anterior extremity of the dorsal lines, a third on each side of the mouth, and a fourth extends on each side of the belly, from the level of the spiraculum nearly to the origin of the hind limbs, its anterior extremity bent downwards and forwards. This specimen is figured above, p. 598, fig. 3, C.

Lead-grey to blackish above, uniform or with round blackish spots ; sides with large silvery or pale golden spots ; belly greyish white with metallic spots ; tail with numerous dark brown dots or round black spots, which are very apparent on the greyish-white crests. Nearly black tadpoles are on record (Héron Royer, Bull. Soc. Zool. France, 1878, p. 62), and an albino has been figured (Lataste, Actes Soc. Linn. Bord. xxxiv. 1880, pl. xi.).

The largest tadpoles I have seen were obtained by me in company with my friend M. Lataste, in May 1882, at St. Germain-en-Laye, near Paris. The following are the measurements of one of them :— Total length 80 millim. : body 28, width of body 21 ; tail 52, depth of tail 19. Héron Royer and Van Bambeke also mention specimens 85 millim. long, and Fischer-Sigwart ('Das Thierleben im Terrarium,' Zofingen, 1889, p. 61) gives 90 millim. as the maximum length ; but this size is exceptional, some specimens, although full-grown, not exceeding 40 millim.

I cannot find any constant character differentiating the Spanish-Portuguese tadpoles (var. *boscæ*, Lataste) from the typical form, except that the tail is usually spotted with deeper black.

The tadpole of *Alytes obstetricans* has been described and figured many times. In addition to the anatomical works of C. Vogt (Unters. iib. d. Entwickl. d. Geburtshelferkröte, Solothurn, 1842), Keiffer (Arch. de Biol. ix. 1888, p. 55, pls. iii. & iv.), and Héron Royer and Van Bambeke (*t. c.* p. 285, pl. xxii. fig. 1), containing information respecting the buccal characters, the contributions must be mentioned of Pontallié (Ann. Sc. Nat. 3, xviii. 1852, p. 248), Lataste (Actes Soc. Linn. Bord. xxi. 1876, p. 446, pl. ix. figs. 1–3, 7–9), Héron Royer (Bull. Soc. Zool. 1878, p. 132, pl. iii. figs. 9–11), and Bedriaga (Bull. Soc. Nat. Mosc. 1889, p. 603, and "Les Larves des Batraciens de Portugal," Coïmbre, 1891, p. 12).

The Midwife Toad is common nearly all over France¹, in Belgium (Provinces of Namur, Liège, and Luxemburg), in Switzerland, distributed locally in Germany as far east as Brunswick and Thuringia (Nehring, Sitzb. Ges. nat. Fr. Berl. 1887, p. 48, and Naturw. Wochenschrift (Berlin), v. 1890, p. 278 ; Wolterstorff, Zool.

¹ I have failed to find it in the northern parts of Ille-et-Vilaine and the adjoining parts of the Côtes-du-Nord, although the species is said by Pontallié to be quite common near Rennes.

Anz. 1891, p. 65). It has been found as high up as 5000 feet in Switzerland (Fatio, Vert. Suisse, iii. p. 362) and 6500 feet in the Pyrenees. In Spain and Portugal it is represented by a distinct variety (var. *boscæ*, Lataste).

Its tadpole is one of the most useful for anatomical and physiological purposes, both on account of its size and the facility with which it can be procured, being abundant wherever it exists and found all through the year, often remaining two years before transforming (Wiedersheim, Zool. Anz. 1878, p. 104). The breeding-season lasts from the spring to the end of summer. The tadpole, which does not leave the egg until after the loss of the (uncommonly large) external gills, is usually deposited in small reservoirs, cow-ponds, flooded quarries, pits in brick-fields, &c. For accounts of the breeding-habits of *Alytes obstetricans*, consult A. de l'Isle du Dréneuf, Ann. Sc. Nat. 6, iii. 1876, art. 7, and Héron Royer, Bull. Soc. Zool. France, 1886, p. 671.

19. ALYTES CISTERNASII, Boscá. (Plate XLVII. fig. 8.)

I am indebted to M. Ed. Boscá, the discoverer of this very distinct species, for several tadpoles, from the Sierra Morena, at different stages of development. The largest measures 69 millim. : body 20, width of body 15; tail 42, depth of tail 14.

I regret to be unable to detect any character by which this tadpole may be surely distinguished from that of *A. obstetricans*. Héron Royer and Van Bambeke state that the labial teeth are less distinctly arranged in double rows, and their figure, in fact, represents the second upper series only as formed of a double row. Bedriaga, on the contrary, describes the first upper series as with two rows of teeth and the second with two or three, the first and second lower series with two rows and the third with three, just as is usually the case in *A. obstetricans*. I find constantly two rows in the first upper and first lower series, two or three in the second upper, two in the second lower, and two or three in the third lower. Bedriaga adds that the tail is shorter than in *A. obstetricans*, only about once and a half the length of the body; this difference, again, is not borne out by our specimens, as may be seen from the measurements given above.

Tail with small black spots, more crowded and often forming vermiculations on the muscular portion of the tail, the space occupied by the lateral groove being, however, usually free from spots.

The tadpole of *A. cisternasii*, which inhabits Spain and Portugal, has been figured by Boscá (An. Soc. Esp. x. 1881, pl. ii. figs. 4-6) and described by Héron Royer and Van Bambeke (*l. c.* p. 289, pl. xxii. fig. 5) and by Bedriaga (Larves des Batraciens de Portugal, Coïmbre, 1891, p. 14). It is to be found all the year through (Boscá, Bull. Soc. Zool. France, 1880, p. 253).

APPENDIX.

List of the Specimens preserved in the British Museum.

(N.B.—No number of specimens higher than ten in each bottle is recorded in this list.)

1. *Rana esculenta*.

1-10.	Near St. Malo.	G. A. Boulenger, Esq. [P.].
11-12.	Bologna.	Prof. Bianconi [P.].
13-22.	Prague.	Hr. V. Fritsch [C.].
23-27.	Coimbra.	Dr. J. de Bedriaga [P.].
28-32.	Algeria.	M. Héron Royer [E.].

} var. *ridibunda*.

2. *Rana arvalis*.

1-4.	Copenhagen.	M. Héron Royer [E.].
5-14.	Halle/S.	Dr. W. Wolterstorff [E.].
15-24.	Breslau.	Prof. G. Born [P.].

3. *Rana temporaria*.

1-10.	Near London.	G. A. Boulenger, Esq. [P.].
11-15.	Sjælland, Denmark.	Copenhagen Museum.
16-22.	Rossazza, Alpes de Biella, 3100 feet.	Prof. L. Camerano [P.].
23-32, 33-36.	Ceresole Reale, 5600 feet.	Prof. L. Camerano [P.].
37-46.	Alpe la Vecchia, Biellesl, 7000 feet.	Prof. L. Camerano [P.].

4. *Rana græca*.

1-10.	Parnassos.	Dr. Krüper [P.].
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5. *Rana iberica*.

1-2.	Coimbra.	Dr. J. de Bedriaga [P.].
3-4.	Portugal.	M. Héron Royer [E.].

6. *Rana latastii*.

1.	Italy.	M. Héron Royer [E.].
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7. *Rana agilis*.

1-10.	Near St. Malo.	G. A. Boulenger, Esq. [P.].
11-14.	Near Paris.	M. Héron Royer [E.].

8. *Hyla arborea*.

1-10, 11-20.	Near St. Malo.	G. A. Boulenger, Esq. [P.].
21-30.	Near Nice.	Dr. J. de Bedriaga [P.].

(Var. *meridionalis*.)

9. *Bufo vulgaris*.

1-10.	Near London.	G. A. Boulenger, Esq. [P.].
11-14.	Sjælland, Denmark.	Copenhagen Museum.
15-19.	Near Nice.	Dr. J. de Bedriaga [P.].

10. *Bufo viridis*.

1.	Bonn.	Dr. J. de Bedriaga [P.].
2-6.	Fildmoching, near Munich.	Dr. W. Wolterstorff [E.].
7-16.	Breslau.	Prof. G. Born [P.].
17-18.	Italy.	M. Héron Royer [E.].
19-22.	Near Turin.	Prof. L. Camerano [P.].
23-28.	Ischia.	Copenhagen Museum.
29-30.	Pizzo, Calabria.	Prof. H. Giglioli [P.].
31-40.	Do Shak, Afghanistan.	Dr. Aitchison [C.].

11. *Bufo calamita*.

1-10.	Near St. Malo.	G. A. Boulenger, Esq. [P.].
11-15.	Mertola, Portugal.	Dr. J. de Bedriaga [P.].

12. *Pelobates fuscus*.

1-3.	Near Paris.	M. Héron Royer [E.].
4-5.	Near Basle.	Dr. F. Müller [P.].
6-15.	Halle/S.	Dr. W. Wolterstorff [E.].
16-25.	Prague.	Dr. V. Fritsch [C.].
26-29.	Sjælland, Denmark.	Copenhagen Museum.
30.	Bologna.	Prof. Bianconi [P.].

13. *Pelobates cultripes*.

1-2.	Hérault.	M. Héron Royer [E.].
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14. *Pelodytes punctatus*.

1-10, 11-20.	Near St. Malo.	G. A. Boulenger, Esq. [P.].
21-27.	Near Paris.	M. Héron Royer [E.].
28-37.	Cimiez, near Nice.	Dr. J. de Bedriaga [P.].

15. *Discoglossus pictus*.

1-2.	Montecristo Island.	Prof. H. Giglioli [P.].
3-6.	Algiers.	Dr. J. de Bedriaga [P.].
7-14.	Algeria.	M. Héron Royer [E.].

16. *Bombinator igneus*.

1-5.	Magdeburg.	M. Héron Royer [E.].
6-11.	Sjælland, Denmark.	Copenhagen Museum.

17. *Bombinator pachypus*.

1.	Gironde.	Copenhagen Museum.
2-5.	France.	M. Héron Royer [E.].
6-15.	Mondorf, Luxemburg.	G. A. Boulenger, Esq. [P.].
16-20.	Niedertellendorf, Franconia.	Dr. W. Wolterstorff [E.].

18. *Alytes obstetricans*.

1-10.	Near Paris.	G. A. Boulenger, Esq. [P.].	
11-17.	St. Germain-en-Laye.	G. A. Boulenger, Esq. [P.].	
18-20.	Bonn.	Dr. J. de Bedriaga [P.].	
21-24.	Freiburg i. B.	Dr. J. de Bedriaga [P.].	
25.	Ballaigues, Switzerland.	Dr. J. de Bedriaga [P.].	
26-31.	Lac Bleu, Hautes-Pyrénées, 6500 feet.	Dr. L. Joubin [E.].	
32-33.	Corunna.	M. V. L. Seoane [P.].	} (Var. boscé.)
34-37.	Coimbra.	Dr. J. de Bedriaga [P.].	
38-39.	Serra Estrella.	Dr. H. Gadow [C.].	
40-45.	Valencia.	M. E. Boscá [P.].	

19. *Alytes cisternasii*.

1-4.	Sierra Morena.	M. E. Boscá [P.].
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EXPLANATION OF THE PLATES.

PLATE XLV.

- Fig. 1. *Rana esculenta*, p. 604. Near St. Malo.
 2. — *arvalis*, p. 605. Breslau.
 3. — *temporaria*, p. 606. Near London.
 4. — *græca*, p. 607. Parnassos.
 5. — *iberica*, p. 608. Coimbra.
 6. — *latastii*, p. 608. Italy.
 7. — *agilis*, p. 609. Near St. Malo.

PLATE XLVI.

- Fig. 1, 2. *Hyla arborea*, p. 610. Near St. Malo.
 3. ———, var. *meridionalis*, p. 611. Near Nice.
 4. *Bufo vulgaris*, p. 612. Near London.
 5. ——— *viridis*, p. 612. Breslau.
 6. ——— *calamita*, p. 614. Near St. Malo.
 7. *Pelobates fuscus*, p. 614. Prague.
 8. ——— *cultripes*, p. 616. Hérault.

PLATE XLVII.

- Fig. 1, 2. *Pelodytes punctatus*, p. 617. Near St. Malo.
 3. *Discoglossus pictus*, p. 620. Montecristo.
 4. *Bombinator igneus*, p. 621. Sjælland, Denmark.
 5. ——— *pachypus*, p. 621. Mondorf, Luxemburg.
 6. *Alytes obstetricans*, p. 622. St. Germain, near Paris.
 7. ——— var. *boscæ*, p. 624. Serra Estrella.
 8. ——— *cisternasi*, p. 624. Sierra Morena.

The tadpoles are represented of the natural size. The mouth (α) is enlarged 5 diameters in fig. 7, Pl. XLVI.; 15 diameters in figs. 4 and 6, Pl. XLVI., and fig. 3, Pl. XLVII.; 7 diameters in fig. 8, Pl. XLVI., and fig. 6, Pl. XLVII.; 10 diameters in the rest.

December 1, 1891.

Henry Seebohm, Esq., F.Z.S., in the Chair.

Mr. Sclater exhibited a specimen of a Shearwater which had been captured alive in Victoria Park, Sydney, on August 2nd, 1891, having been driven on land by the heavy storm. It had been brought to England from Australia by Prof. Anderson Stuart and was to be deposited in the British Museum. Mr. Sclater read the following extract from a letter from Mr. O. Salvin, F.R.S., concerning the identification of this bird:—

“I have examined the Petrel you sent me. It proves to be a specimen of *Puffinus gavia*, Forst. I have compared it with an example from New Zealand in the Cambridge Museum kindly lent me by Prof. Newton, and find the two birds precisely alike.

“*Puffinus gavia* is not uncommon on the coasts of New Zealand, but it has not to my knowledge been detected near Australia. A full account of the species will be found in Buller’s ‘Birds of New Zealand,’ ed. 2, ii. p. 236.”

Dr. Edward Hamilton, F.Z.S., exhibited an example of the Red-breasted Snipe of North America (*Macrorhamphus griseus*) shot near Crinan in Argyllshire, as noticed in the ‘Zoologist’ for 1891 (Zool. ser. 3, xv. p. 427), and stated to be the second example of this bird procured in Scotland.

Mr. Seebohm exhibited and made remarks on five rare Irish birds from the collection of Mr. R. M. Barrington, of Bray, in County Wicklow. No fewer than four of these had been caught by Mr. W. H. James, the light-keeper at the Tearaght Rock, the most westerly

station in Europe. An example of the Mealy Redpoll (*Fringilla linaria*) was caught on the 14th of September, 1890; a Lesser White-throat (*Sylvia curruca*) was caught seventeen days later; a Yellow-browed Warbler (*Phylloscopus superciliosus*) after a further interval of fourteen days; and a Red-breasted Flycatcher (*Muscicapa parva*) six days later still. In the meantime, on the 11th of October in the same year, the fifth specimen exhibited had been caught at the Black Rock Lighthouse in County Mayo, and proved to be a Short-toed Lark (*Alauda brachydactyla*).

Mr. W. B. Tegetmeier, F.Z.S., exhibited and made remarks on an abnormal growth of the bill of a Rook (*Corvus frugilegus*), and on the head of a Pheasant with the upper mandible entirely wanting, which had been forwarded to him by Mr. E. L. Layard, F.Z.S.

The following papers were read:—

1. Notes on Transcaspian Reptiles.

By G. A. BOULENGER.

[Received October 28, 1891.]

Since the publication, in 1888, of Dr. Boettger's excellent account of the herpetological results of the Radde-Walter Expedition to Transcaspia¹, the British Museum has acquired, partly through the kind mediation of Dr. Boettger himself, a large number of Reptiles from the same district, which enable me to supplement the above work and to add six species which have not been recorded before from the Russian Empire. The fact of the occurrence so far west of the Indian species *Eumeces scutatus*, *Lycodon striatus*, and *Dipsos trigonata* is of great interest, as is also the rediscovery of *Ophiomorus brevipes*, hitherto known from a single specimen preserved in the Calcutta Museum.

The material upon which these notes are based consists of the following series:—

1. The first set of duplicates of Dr. Radde's collection, 30 specimens, including types of *Phrynocephalus raddii*, Bttg. Received in 1888.
2. 22 specimens from Ashabad, collected by M. C. Eylandt. Received in 1890.
3. 28 specimens from Ashabad and Tedshen, near Merv. Received in exchange from the Warsaw Museum in 1890.
4. 7 specimens obtained by M. P. A. Warentzoff at Ashabad. Received in 1891.
5. 20 specimens from Bokhara, the Copet Dagh near Ashabad, Achal, and Alexandrowski. Received in exchange from M. P. Nazaroff, 1891.

¹ "Die Reptilien und Batrachier Transkaspiciens," Zool. Jahrb. iii. 1888, pp. 871-972, pl. xxxiv.

6. 73 specimens obtained by M. C. Eylandt at Puli Hatun at the confluence of the Geshef-Rud and the Hari-Rud. Received in 1891.

TERATOSCINCUS SCINCUS, Schleg.

I have now six Transcaspien specimens before me, measuring from 40 to 90 millim. from snout to vent: five from Ashabad (Eylandt and one from Puli Hatun. In one of these specimens (from Ashabad) the scales on the back of the head are larger than on the snout, as described by Boettger, the five others having them smaller than on the snout or at any rate not larger. Nostril between the rostral and four nasals; upper nasals in contact with each other behind the rostral in the specimens from Ashabad, separated by one scale in the one from Puli Hatun. Mental as long as broad or longer. 29 to 31 scales round the middle of the body. Head variegated with dark brown; nape and back with black cross-bands, the anterior of which are crescentic.

CROSSOBAMON EVERSMANNI, Wieg.

This Gecko must be one of the commonest Sand-Lizards in Transcaspien, as every collection made in that district contains numerous specimens. The number of præanal pores varies from six to nine.

GYMNODACTYLUS CASPIUS, Eichw.

The Museum now possesses the following series of specimens, in all of which I have counted the longitudinal rows of ventral scales (V.) and (in the males) the femoro-præanal pores (P.) :—

			V.	P.	
1.	♂.	Krasnowodsk.	St. Petersburg Mus.	26	29
2.	♂.	Ak-kala, near Astrabad.	"	26	24
3.	♂.	"	"	28	24
4.	♂.	Ashabad.	Eylandt.	26	26
5.	♂.	"	"	26	26
6.	♀.	"	"	26	
7.	♀.	"	"	24	
8.	♂.	"	Warentzoff.	28	31
9.	♂.	"	"	28	28
10.	♀.	"	Warsaw Mus.	26	
11.	Yg.	"	"	26	
12.	♀.	Copet Dagh.	Nazaroff.	28	
13.	♀.	"	"	28	
14.	♀.	Bokhara.	"	30	
15.	♂.	Durun.	Radde.	24	26
16.	♀.	Tachta.	"	26	
17.	♂.	Puli Hatun.	Eylandt.	26	28
18.	Yg. ♂.	"	"	28	29
19.	Yg. ♂.	"	"	24	30

Thus we see that the number of scales across the belly varies in these Transcaspien specimens from 24 to 30, and the number of pores from 24 to 31 (34 in one specimen examined by Boettger),

thus closely approaching, with respect to these characters, Strauch's *G. fedtschenkoi*, which is described as having 30 to 32 rows of ventrals, and 34 to 37 pores. In fact, one of the specimens (no. 16) in the above list has been referred by Boettger to *G. fedtschenkoi*. As to the other characters taken from the tubercles on the back of the head and body, I find so much variation within certain limits in our specimens, all undoubtedly of one and the same species, that I should have endorsed Boettger's opinion that *G. fedtschenkoi* may after all not be specifically separable from *G. caspius*, if it were not for the recent accession of a specimen from Kelif, Bokhara, which I regard as representing the true *G. fedtschenkoi*.

GYMNODACTYLUS FEDTSCHENKOI, Strauch.

A single specimen from Kelif, Bokhara. Tubercles smaller than in *G. caspius*, more as in *G. scaber*, strongly keeled but not trihedral on the back, where they form 12 series; round and convex, not keeled, on the occiput and temples. 30 scales across the middle of the belly. Although a female, the specimen shows, as mere impressions, a series of 29 femoro-præanal pores.

EUBLEPHARIS MACULARIUS, Blyth.

I have related (Ann. & Mag. N. H. vi. 1890, p. 352) the curious circumstance under which the presence of this Lizard near Ashabad was ascertained by M. Eylandt.

EREMIAS GUTTULATA, Licht.

I have examined specimens from the Copet Dagh (Nazaroff) and Puli Hatun (Eylandt). As I have not found specimens of *Lacerta muralis* among the collections made in those localities, it is probable that the Lizards mentioned by Boettger (*l. c.* p. 907) as having been seen, but not captured, by Walter on the northern slope of the Copet Dagh belonged to *Eremias guttulata*.

EUMECES SCUTATUS, Theobald.

This Scink was known from Sind, Cutch, the Punjab, and Cashmere. Its discovery by M. Eylandt so far west as Puli Hatun is therefore of considerable importance. All the 15 specimens examined have 21 scales round the middle of the body and two azygous postmentals; in one specimen the frontoparietals form a very short median suture, in the others the frontal is in contact with the interparietal. Pale brown or olive-grey above, white beneath; the small specimens have three darker longitudinal bands and are spotted with black, the black spots being crowded and intermixed with white ones on the lateral bands; upper surfaces and sides of tail with black spots very regularly disposed, a spot occupying every other scale in each longitudinal series. These markings may almost completely disappear in the adult. The largest specimen measures 300 millim., the tail entering for 180.

E. scutatus occurs at Puli Hatun in company with *E. schneideri*, both species being well represented in M. Eylandt's collection.

OPHIOMOROUS BREVIPES, Blanf.

This species, the type of Blanford's genus *Zygnopsis* or *Zygnidopsis*, was established upon a single specimen, with the head slightly injured, obtained at Sáadatabád, a village about 100 miles south-west of Karman, on the road to Shiraz; this specimen, figured in the 'Zoology of Eastern Persia,' pl. vii. fig. 4, is preserved in the Calcutta Museum. In 1879, two specimens from the Southern Coast of Persia or Baluchistan were referred by Blanford to the same species¹. A few years later, when preparing the Catalogue of Lizards, I came to the conclusion that the latter specimens belong to a species distinct from *O. brevipes*, for which I proposed the name of *O. blanfordii*, and this view is now fully confirmed on the rediscovery, at Puli Hatun, of the true *O. brevipes*. 10 specimens were sent by M. Eylandt. They differ at first sight from *O. blanfordii* in the less depressed, more conical snout, and the somewhat larger eye; they further differ in having 22 scales round the body instead of 20, and the interparietal as broad as long instead of longer than broad. Nostril nearer the rostral than to the anterior loreal; frontonasal two fifths to one half the length of the frontal, which is a little longer than broad; usually, only the first supraocular forms a suture with the præfrontal, but sometimes the second also, as in *O. blanfordii*; interparietal as long as broad or a little broader; a pair of enlarged nuchals may be present; fifth upper labial largest; two azygous postmentals. Length of hind limb $3\frac{2}{3}$ to $4\frac{2}{3}$ times in the distance between the shoulder and the thigh.

Coloration as described and figured by Blanford. The largest specimen measures 95 millim. from snout to vent.

ERYX JACULUS, L.

All the specimens I have examined fall into Boettger's var. *miliaris*, Pall., and I record the following numbers from four specimens in the British Museum. Under *a* is given the number of scales from eye to eye, *b* from eye to nasal, *c* round the eye, *d* upper labials, *e* across middle of body, *f* ventrals, *g* subcaudals.

	<i>a.</i>	<i>b.</i>	<i>c.</i>	<i>d.</i>	<i>e.</i>	<i>f.</i>	<i>g.</i>
1. Ashabad (<i>Radde</i>)	7	4	13	13	45	185	23
2. " (<i>Eylandt</i>).....	7	4	12-13	12	45	179	24
3. " (<i>Warsaw Mus.</i>)	8	5	13-14	14	49	180	27
4. Puli Hatun (<i>Eylandt</i>) .	9	4	13	12	47	188	21

I find the following numbers in three specimens from E. Turkestan :—

Ilisk (<i>Lansdell</i>)	{ 8	4	11	11	45	183	21
	{ 9	4	12-11	11-10	43	185	20
	{ 9	3-4	10	10-11	45	172	20

LYCODON STRIATUS, Shaw.

A perfectly typical example, with 177 ventrals and 66 subcaudals, from Puli Hatun, extends to Transcaspia the range of this common

¹ Both are now in the British Museum, thanks to Mr. Blanford's generosity.

Indian Snake, which is known from Sind, the Punjab, the North-Western Provinces, and the hills below Simla to Southern India¹.

PSEUDOCYCLOPHIS WALTERI, Bttg.

Since the description of this species by Boettger in 1888, from a single specimen obtained by Dr. Walter in Transcaspia, close to the North-eastern limit of Persia, I have examined a second specimen found in Sind by Mr. Blanford. Quite recently the British Museum has received, through M. Warentzoff, a half-grown specimen, from Ashabad. It has 235 ventrals and 73 subcaudals. Loreal absent. The upper surface of the head, behind the snout, and the nape blackish; the blackish cross-bars or transverse series of spots well marked on the whole body, but absent from the tail.

ZAMENIS RHODORHACHIS, Jan.

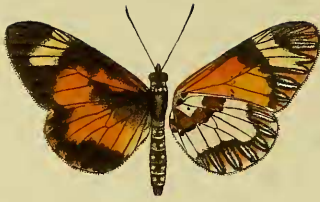
This species may be added to the list of Transcaspian Reptiles, as M. Zaroudnoi's notes² on a dark grey Snake with a bright red vertebral stripe, seen by him at Gjarmaou, Ashabad, Merv, and Tedshen, evidently refer to it. I may add that I now regard *Z. rhodorhachis* (= *Gonyosoma dorsale*, And.) and *Z. ladacensis* as colour varieties of one and the same species, which is perfectly separable from both *Z. ventrimaculatus* and *Z. karelinii*. The South-western Asian species of *Zamenis* may be distinguished as follows:—

- | | |
|---|--------------------------------------|
| A. Scales in 17 rows, smooth; posterior chin-shields in contact with each other | 1. <i>Z. mucosus</i> , L. |
| B. Scales in 19 (exceptionally 17) rows, smooth; posterior chin-shields separated from each other by scales. | |
| <i>a.</i> Frontal not or but slightly wider than the supraocular, more than once and a half as long as broad. | |
| Ventrals rather indistinctly angulate laterally; scales with two apical pits | 2. <i>Z. gemonensis</i> , Laur. |
| Ventrals very distinctly angulate laterally; scales with a single apical pit | 3. <i>Z. dahlii</i> , Fitz. |
| <i>b.</i> Frontal anteriorly considerably wider than the supraocular. | |
| <i>α.</i> Nine upper labials, two of which enter the eye. | |
| Ventrals 214–255; subcaudals 124–145... | 4. <i>Z. rhodorhachis</i> , Jan. |
| Ventrals 199–211; subcaudals 82–99 | 5. <i>Z. ventrimaculatus</i> , Gray. |
| <i>β.</i> Nine upper labials; a subocular separates the eye from the sixth labial..... | 6. <i>Z. karelinii</i> , Strauch. |
| <i>γ.</i> Eight upper labials | 7. <i>Z. elegantissimus</i> , Gthr. |

¹ In a recent paper on Indian Snakes (Journ. As. Soc. Beng. lx. 1891, p. 233), Mr. W. L. Selater expresses doubts as to the existence of this Snake in Southern India, its resemblance to *L. travancoricus*, Bedd., rendering, in his opinion, confusion of the two by no means impossible. I therefore seize this opportunity to state that several specimens, collected by Col. Beddome in Wynaad and the Anamallays, are in the British Museum. In addition to the characters I have previously indicated, *L. striatus* differs from *L. travancoricus* in having the loreal shield in contact with the internasal, as in *L. aulicus* and *L. anamalensis*.

² Bull. Soc. Nat. Mosc. 1890, p. 291.

1.



2.



3.



5.



4.



6.



- C. Scales in 21 rows or more, more or less distinctly keeled.
- Scales in 21 (rarely 23) rows; nine or ten upper labials, fifth and sixth entering the eye..... 8. *Z. ravergeri*, Mén.
- Scales in 23 or 25 rows; nine or ten upper labials, fifth (rarely fifth and sixth) entering the eye..... 9. *Z. nummifer*, Reuss.
- Scales in 25 to 33 rows; ten to thirteen upper labials, none entering the eye 10. *Z. diadema*, Schleg.
- D. Scales in 41 to 43 rows, smooth; 14 or 15 upper labials, none entering the eye 11. *Z. microlepis*, Jan.

Z. nummifer, Reuss (*neglectus*, Jan), should perhaps be regarded as a variety of *Z. ravergeri*, Mén. (*caudælineatus*, Gthr., *fedtschenkoi*, Strauch), rather than as a distinct species. In addition to the characters mentioned above, it differs in having the upper portion of the præocular smaller and the anterior pair of temporals more enlarged.

DIPSAS TRIGONATA, Schn.

Another well-known Indian Snake to add to the fauna of Transcaspia. A fine specimen is in M. Eylandt's collection from Puli Hatun.

2. Descriptions of New Butterflies collected by Mr. F. J. Jackson, F.Z.S., in British East Africa, during his recent Expedition.—Part II.¹ By EMILY MARY SHARPE.

[Received October 30, 1891.]

(Plate XLVIII.)

Fam. NYMPHALIDÆ.

Subfam. DANAINÆ.

Genus AMAURIS.

AMAURIS JACKSONI, sp. n. (Plate XLVIII. fig. 2.)

Intermediate between *A. echeria*, Stoll, and *A. lobengula*, E. M. Sharpe; but is easily distinguished from both these species by the great difference in the markings of the hind wing.

Fore wing. Dark brown or nearly black, relieved by white spots placed exactly in the same position as in *A. lobengula*, but all the spots are pure white instead of yellow. An oblong white spot in the middle of the discoidal cell; an ovate spot below the cell between the first and second median nervules, and a very small one near the posterior angle, between the submedian nervure and the first median nervule; this spot is the commencement of a row of four spots extending to the apex, the second spot being the smallest and placed between the first and second median nervules, the third one just above, and the fourth spot between the first radial or discoidal

¹ See P. Z. S. 1891, p. 187.

nervule and the fifth subcostal nervule; close to the hind margin are three minute spots, one just below the second median nervule, and the two others above the latter, placed closed together, between the second and first median nervules; two spots above the end of the discoidal cell varying in size; three small spots on the costal margin placed somewhat apart from each other, the third one being near the apex, and having a small triangular-shaped spot placed in the fork of the fourth and fifth subcostal nervules, just below the costal spot.

Hind wing. In colour and markings resembling *A. lobengula*, except as regards the ochre patch, which is of the same shape as in *A. echeria*. The brown border is very broad, and is relieved by two rows of spots varying very much in size and all entirely of a yellow colour, the first row close to the hind margin consisting of small twin spots placed between the nervules, the second row having the sixth spot from the costa (below the third median nervule) the largest, the ninth ending just above the first median nervule. The transverse band of ochre is very deep in colour and somewhat wider than in *A. echeria*, and is covered with black hairs near the inner margin.

Base of wing dark brown.

Underside resembling that of *A. lobengula* very closely, the general colour being rather darker than in either this species or *A. echeria*. The white spots are all very distinct, but vary somewhat in size.

Expanse $3\frac{1}{2}$ inches.

Hab. Sotik, Kavirondo, Sept. 1889.

Subfam. ACÆRINÆ.

Genus ACÆRÆ.

ACÆRÆ SOTIKENSIS, sp. n. (Plate XLVIII. fig. 1.)

Allied to *A. bonasia*, Fabr., but is easily distinguished by the pale yellow patch near the apex of the fore wing, and by the transverse band on the hind wing inclining to pale yellow towards the inner margin.

Fore wing. Costa, apex, hind margin, and base of wing along the inner margin to about the middle of the wing deep velvety black. A streak of rufous on the lower half of the discoidal cell; this streak is inclined to break through the black band which crosses the wing near the end of the discoidal cell, as in *A. bonasia*; the patch of orange-yellow wider, and the pale yellow patch near the apex is much larger than in the latter species.

Hind wing. Base black; the orange transverse band rather wider, fading to pale yellow about the middle of the wing, continuing to the inner margin and becoming gradually narrower. The hind marginal border is slightly narrower as far as the third median nervule, when it becomes wider than in *A. bonasia*. This border is relieved by five minute triangular-shaped spots of orange-yellow, between each nervule, terminating above the first median nervule.

Underside.—*Fore wing.* Basal area rufous, paler along the inner margin, the patch of orange on the upperside being decidedly lighter below. Costa black as far as the apical patch above the discoidal cell, which then becomes more indistinct and very much dentated towards the inner margin. The hind margin is edged with a narrow border of orange-yellow which extends in thin rays between the nervules, each nervule being distinctly marked with black, and having a black ground with a line of yellow on either side of the nervules.

Hind wing. Base of wing yellow, with a narrow transverse band of deep rufous extending from the costa to the inner margin and spreading up to the base. This transverse band is outlined on either side with small black spots, which become more numerous at the inner margin. Middle portion of wing pale yellow, followed by a submarginal border of eight nervules, black, with a streak of yellow on both sides and then outlined with black. Between each of these nervules is a streak of orange-yellow; also at the very edge of the wing are seven triangular-shaped spots of pale yellow, the last spot (counting from the costa) being the smallest.

Expanse 1·8 inch.

Hab. Sotik, Kavirondo, Oct. 1889.

Genus PLANEMA.

PLANEMA LATIFASCIATA, sp. n. (Plate XLVIII. fig. 6.)

Nearest to *P. euryta*, Linn., but is easily distinguished by the deep chestnut-colour at the base of the fore wing and by being so much smaller in size.

Fore wing. Base and greater part of basal area deep rufous brown or chestnut, edged with a narrow outline of black, which is very strongly dentated below the discoidal cell, becoming almost invisible towards the inner margin. Across the middle of the wing is a band of deep orange-yellow, much dentated externally on the first, second, and third median nervules; this band becoming much narrower at the inner margin. A large portion of the apex black or very dark brown, which colour continues along the hind margin, though decreasing very much in width towards the inner margin.

Hind wing. Rufous base much more restricted than in the fore wing, though somewhat lighter than in the latter. A transverse band of pale cream-colour or yellow crosses the middle of the wing, increasing slightly in width to the inner margin. This band is followed by a very broad border of black or deep brown along the hind margin, this colour extending along the nervules, while there are also internervular rays of the same colour reaching to about the middle of the transverse band. There are a few black spots at the base.

Underside. Very similar to the upperside, though the fore wing is much lighter in colour.

Hind wing. Base as dark as that in the fore wing, having two small black spots above the cell, one in the middle, and a streak or

comma close to the end of the latter ; two very minute black spots above the first radial and second subcostal nervules, two black spots below the cell corresponding to those above the cell, and two very minute black spots below the internal nervure. Transverse band white, followed by the same broad border of light brown on the hind margin as on the upperside. The nervules and internervular markings are somewhat darker.

Thorax black, with a row of white spots ; body black, with narrow lines of yellow marking the joints, and with large oval-shaped spots of the same colour on each side. Underside of body entirely yellow.

Expanse $2\frac{1}{2}$ inches.

Hab. Mount Elgon, Feb. 1890.

Fam. LYCÆNIDÆ.

Genus CASTALIUS.

CASTALIUS MARGARITACEUS, sp. n. (Plate XLVIII. fig. 3.)

Intermediate between *C. carana*, Hew., and *C. lactinatus*, Butler.

Fore wing. Creamy white ; the base, costa, apex, and hind margin broadly marked with black, with no indication of white near the apex as in *C. carana*. A small streak of black extends from the costal margin along the end of the discoidal cell.

Hind wing. Closely resembling that of *C. lactinatus*. The submarginal black border consisting of six white spots with black ocelli, each separated by the black nervules ; these spots are rather pointed towards the base. There are a few black spots beyond this border, and a slight shading of black at the base.

Underside. Differs very much from that of either species.

Fore wing. With a black streak close to the base, followed by two small black spots, one above and the second below the median nervure ; a minute spot and streak at the end of the discoidal cell ; two submarginal rows of black spots, commencing from the costal margin and gradually uniting above the submedian nervure. The row of white subovate spots is very distinct, each having a small black centre.

Hind wing. Similar to the fore wing, but having a few more spots near the base ; the black streak at the end of the cell is visible as in the fore wing, also the two submarginal rows of black spots, though more broken, and the subovate spots of white have larger centres with silvery-green ocelli.

Expanse 1 inch.

Hab. Sotik, Kavirondo, Sept. 1889.

Genus HYREUS.

HYREUS CORDATUS, sp. n. (Plate XLVIII. fig. 4.)

Nearest to *H. juba*, Fabr., but at once distinguished by the heart-shaped patch of black velvet near the apex.

Fore wing. Brown tinged with bronze, and with faint blushes of bright violet. Near the apical portion of the wing a large heart-shaped patch of velvety black. Cilia brown, alternately marked with white, but not very distinctly.

Hind wing. Similar to the fore wing, slightly darker at the base. The first median nervule terminates with a fairly long tail, having on either side a bright green ocellus edged round with black, the second one being the smaller of the two and terminating at the end of the submedian nervure. Cilia similar to the fore wing but much more distinct.

Underside very distinct from that of *H. juba*.

Fore wing. Ground-colour pearly white; the basal area, especially just below the discoidal cell, shaded with light brown. Costal margin alternately marked with brownish black, which extends through the cell to the median nervure in bars; near the apical portion is another black bar, separated at the costal margin by a spot of white, which decreases in width to the second median nervule. The submarginal border is black, having a thin white line much dentated, then another edging of black not so distinct, and also six white spots, those near the apex being more distinct and separated from each other by the nervules. Cilia much more distinct than on the upperside.

Hind wing. White, with numerous spots and markings near the base, which become thicker towards the inner margin; the end of the cell is marked by an outline of black. Near the costa, about the middle of the wing, is a round spot of black with a large white centre, and at the end of the costal nervure is a figure of 8 outlined with black and having white centres. Straight from the end of the cell and situated some little way off is a spot, very much pointed towards the hind margin, with two smaller spots, one on either side, all outlined with black, leaving the centres white. Near the hind margin is a submarginal border of white, very finely edged with black lines on the upper and lower sides, leaving white centres which are rather dentated towards the base. Between the first and second median nervules the black is much more distinct, and is relieved by a minute black spot, edged on either side by small specks of brilliant emerald-green, which become of a reddish bronze on the side close to the cilia; there is another spot of the same description, but with less green, between the submedian nervure and the first median nervule; this spot is also rather smaller than the other. Cilia nearly all white.

Expanse 1·4 inch.

Hab. Sotik, Kavirondo, Sept. 1889.

Genus LYCÆNA.

LYCÆNA ÆQUATORIALIS, sp. n. (Plate XLVIII. fig. 5.)

Allied to *L. palemon*, Cram., but easily distinguished by the different shade of blue on the wings, this blue colour being brighter and more distinct than in the species referred to.

Fore wing. Cilia distinctly marked alternately with white and brown; a narrow border of brown on the hind margin extending from the inner margin to the apex, this border being broader than in *L. palemon*; the costa very slightly edged with brown, which is more distinct towards the base of the wing. The rest of the wing blue.

Hind wing. Similar to the fore wing, but differing from *L. palemon* in that the hind wing of the latter has a distinct little tail, whereas *L. æquatorialis* seems to lack this character entirely.

Underside.—*Fore wing* light brown, with a slight indication of the markings as in *L. palemon*. Near the apex one small white spot.

Hind wing. Light brown relieved by white bands; hind marginal border brown with a very minute ocellus, black, edged with a faint tinge of yellow on the upper portion, with a tiny speck of green below. This small ocellus is placed between the first and second submedian nervules; the brown border is followed by a transverse band of white commencing narrowly at the costa, widening in the middle, and again decreasing towards the inner margin. About the middle of the wing is a band of dark brown as in *L. palemon*, the only difference being that the wide part extends towards the base instead of proceeding towards the hind margin. Two streaks of white follow, varying very much in size, and with a short bar of brown edged with white; the base is black, dusted with light brown, almost yellow.

Expanse 1·1 inch.

Hab. Mount Elgon, 8500 feet, Feb. 19, 1890.

EXPLANATION OF PLATE XLVIII.

- Fig. 1. *Aeræa sotikensis*, p. 634.
2. *Anauris jacksoni*, p. 633.
3. *Castalius margaritaceus*, p. 636.
4. *Hyreus cordatus*, p. 636.
5. *Lycæna æquatorialis*, p. 637.
6. *Planema latifasciata*, p. 635.

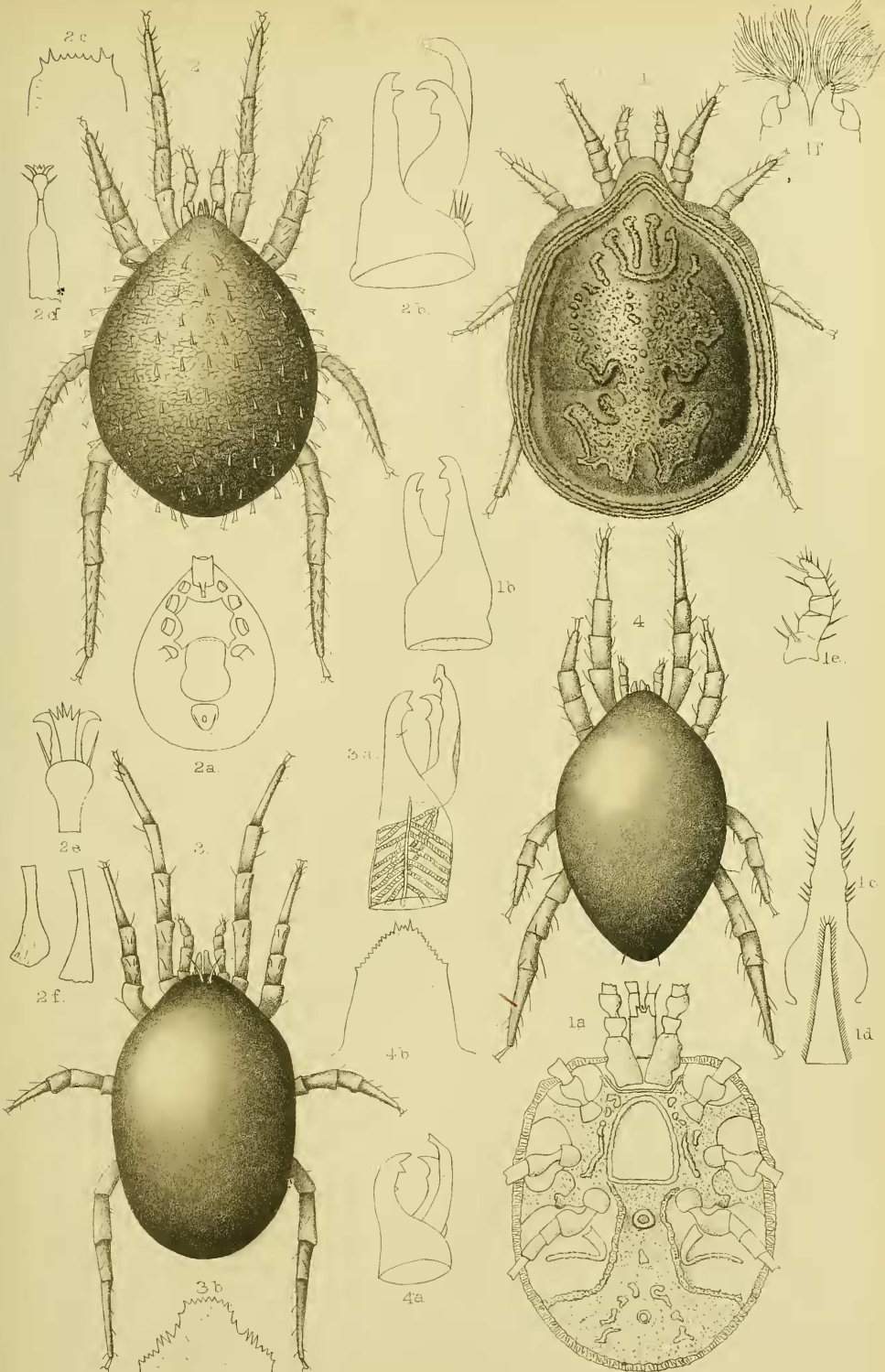
3. On the Association of Gamasids with Ants.

By A. D. MICHAEL, F.L.S., F.Z.S., F.R.M.S., &c.

[Received November 10, 1891.]

(Plates XLIX. & L.)

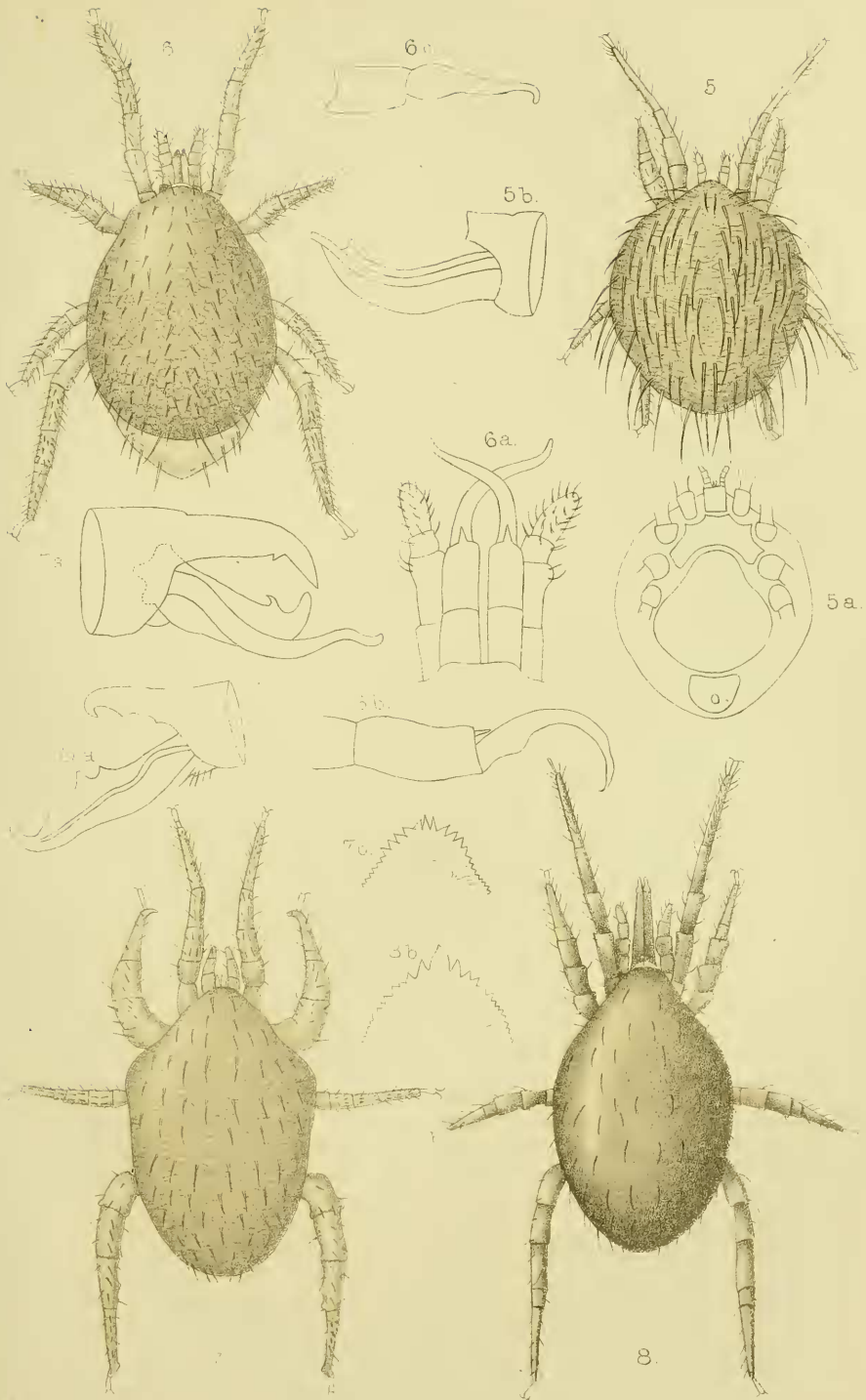
This paper records some observations made during the present year (1891), chiefly near Ajaccio in Corsica and near Innsbruck in Tyrol. In the former locality the Ants' nests examined were at a level of not more than 500 feet above the sea; those in the Tyrol were at levels varying from about 3000 to over 4000 feet above the sea. In both places I had the great advantage of the company of Mr. E. Bostock of Stone, and in the latter also of my cousin Mr. M. J. Michael. Both these gentlemen are excellent collectors, and the search for specimens and finding of new species must be



A.D. Michael, ad nat. del.
W.P. Parker lith.

West, Newman, imp

Gamasidæ from Ants' nests.



Wm. Michael, sculp. del.
M. E. Parker, lith.

Gamasidae from Ants' nests

West, Newman imp.

considered joint work ; the observations and experiments were solely my own, and I alone am responsible for any opinions expressed in this memoir.

For the identification of the species of Ants I am indebted to the kindness of Mr. Edward Saunders.

The *Gamasidæ* are a family of the Acarina ; Mognin¹ considers them to be the most highly organized in the order and the nearest to the Insecta ; in spite of the absence of eyes, which are found in some other families, the great development of the brain and nervous system, and the specialization of the trophi and the alimentary and muscular organs, probably entitle them to this position.

The family may be divided into four well-marked subfamilies, viz. the *Pteroptinæ*, the *Dermanyssinæ*, the *Uropodinæ*, and the *Gamasinæ*—the last-named being far the largest. The *Pteroptinæ* are all parasites of Bats, the *Dermanyssinæ* of Birds or Bats ; these two subfamilies may be wholly omitted from consideration for the purposes of this paper ; it is amongst the *Uropodinæ* and *Gamasinæ* alone that the facts here recorded arise. Both these families are composed of creatures which in their immature stages are soft and white, but in their mature condition are fully chitinized. In the former group the chitin is very dense and hard, in the latter much thinner and tougher ; the former are mostly rather slow and inactive, the latter usually extremely quick and active. It used to be considered that the *Gamasinæ* lived wholly on vegetable matter in a decaying condition ; in the year 1880, however, when I was trying to rear a few of the species in confinement for the purpose of tracing their life-histories, I entirely failed in getting them to live upon vegetable matter, and thinking from the structure of their mouth-organs that they must be predatory, I tried them with a diet of living cheese-mites, upon which they thrive admirably². I have since usually fed them in this manner, or at all events with small Acari or Insects. Col. Blathwayt also, who has made numerous experiments upon rearing them, has adopted my mode of feeding, apparently with complete success, he also having failed with a vegetable diet³. It is evident therefore that some species of *Gamasinæ*, probably not all, are predatory. As to the food of the *Uropodinæ*, I do not think that we have any reliable information as yet : their extremely long and slender mandibles with minute chelæ seem as though intended for introduction into very narrow passages ; their slowness hardly seems fitted for a predatory life, as they certainly do not construct any snare, and I have entirely failed to rear them, and so I believe has Col. Blathwayt⁴.

¹ "Mémoire sur l'organisation et la distribution zoologique des Acariens de la famille des Gamasidés." 'Robin's Journ. de l'anat. et de la physiol.' May 1876, pp. 298-9.

² "Observations on the Life-histories of Gamasinæ," Journ. Linn. Soc., Zool. vol. xv. (1881) p. 298.

³ "On some common Species of Gamasidæ," Journ. of Microsc. and Nat. Sci. n. ser. vol. ii. 1889, p. 102.

⁴ It is easy to rear the creatures in large jars containing quantities of material, but then they are useless for observation.

The numbers of Aphidæ, Coleoptera, and indeed of other insects which are commonly found in Ants' nests are too well known to require any reference by me; but the observations on the presence of Acari in a similar situation are, as far as I know, very few. Forel in his great work 'Les Fourmis de la Suisse,' published in 1874, speaking of Myrmecophilous insects (p. 424), says:—"Acarina appear to enjoy a certain immunity; they run about amongst the ants without exciting their anger; it is rare to see them attach themselves to the bodies of their hosts or to those of the larvæ or nymphs. I have nevertheless observed the fact many times, and as it is the mode of life of most Acari we may probably consider it as general in this instance also. Moreover, living in the nest the Acari do not risk anything in releasing one ant, because they can find as many others as they wish." This is, I believe, his only notice of the subject. It will be seen that Forel does not say what Acari he is talking about, and they are almost as various as the different groups of the Insecta; he also falls into the very general, but by no means correct, view of supposing that the great bulk of the Acarina are parasitic, whereas in fact probably not half the species are ever parasitic, and amongst those that sometimes are so by far the larger proportion are only parasitic in an immature stage, not when adult; and among these a very large number only use their host as a means of conveyance, and are not parasitic in any other sense.

The first notice, which I am aware of, specially connecting any Gamasids with Ants is that of Haller in 1877¹, who describes a species which he makes the type of a new genus and which he received from Dr. Uhlmann, who found it, apparently near Munich, parasitic upon (auf) *Formica nigra*. Haller does not state, and probably did not know, the extent of the parasitism; he had a dozen specimens. At the end of his description Haller says "Parasitic upon Insects, especially Ants;" he does not, however, give any reason why he believes it to be parasitic on anything except *Formica nigra*. This remained the only species of the genus until 1888, when Prof. Berlese described two new species found by A. Balzan². One from Brazil, called "*caput-carabi*," in spite of its name, is not stated to have been found on any insect; but is so called because the whole mite is supposed to resemble the head of a *Carabus*; the other, *viduus*, was found upon a Beetle of the genus *Scarites*.

The next notice is that of Sir John Lubbock, who in 1881 found a very curious *Uropoda* in the nests of *Lasius flavus*; he obtained several specimens, and informed me that it was not uncommon in the nest of that species of Ant. It was called *Uropoda formicariæ*³.

The only other record which I know of refers to one of the species dealt with in this paper, which was unknown when I started

¹ "*Antenophorus uhlmanni*, ein neuer Gamaside," Archiv für Naturgesch. Hft. xliii. p. 57.

² "Acari Austro-Americani quos collegit Aloysius Balzan," Bull. Soc. Ent. Ital. 1888.

³ "Observations on Ants, Bees, and Wasps.—Part VIII.," Journ. Linn. Soc., Zool. vol. xv. (1881) p. 386.

upon my journey, but on my return I found that during my absence Prof. Berlese had described it from specimens he found near Naples. He says "frequently found in Ants' nests," but does not say anything as to the species of Ant or whether found in the nests of more than one species; he calls it *Uropoda canestrina*¹.

I spent the month of April (1891) in Corsica. Above Ajaccio, almost adjoining the top of the garden of the Hôtel Continental, is a little sheltered plain of sandy earth and rock, with scattered bushes and a great number of large, loose stones. On turning these stones over, the larger number are found to cover the nests of some Ant; one of those most frequently found in this locality is the small yellow *Tetramorium cæspitum*, race *meridionale*, Emery, which differs widely from the ordinary type of that species. On examining the nests of this Ant with a lens, I at once noticed some reddish-orange spots, which I at first thought might be Sir John Lubbock's *Uropoda formicariæ*. Placing them under the microscope I found them to be an allied but different and much smaller species, then unknown to me; but which, as above stated, Prof. Berlese had lately found and called after Prof. Canestrini. The *Uropodæ* were on the undersides of the stones and in the passages and chambers of the nest, never, as far as I saw, upon the Ants themselves; they were, as is usual, rather inactive creatures, and did not appear to take much notice of the Ants, nor did the Ants of them. It was not every nest of *T. cæspitum* that contained the *Uropodæ*, but I should think half did; and although not very abundant they were fairly numerous in those nests where they did occur. They were of both sexes and of all ages. I did not find this *Uropoda* in the nest of any Ant except *T. cæspitum*, nor have I ever found it anywhere except in the nests of the Ant.

In the nests of the same species of Ant at the same place we found one of the *Gamasinæ* belonging to the genus *Laelaps*, which I believe to be unrecorded and propose to name *L. equitans*; it is sub-discoidal in form, very small, and is an active, wandering creature, entirely different from the *Uropoda*. It was found, like the *Uropoda*, upon the underside of the covering-stones, and in the passages and chambers of the nest; but it was also found on the Ants themselves, most frequently sitting quietly upon the broad head of the Ant. It did not appear at all like a creature which was permanently resident upon the Ant, but rather like one which was enjoying a short temporary ride; it jumped on to and off the Ant with great activity, and several times when the nest was disturbed or when I thought I was going to catch the *Laelaps* it jumped neatly on to the head of an Ant, which ran off and was immediately lost amongst the swarms of others. The Ant never seemed to be at all inconvenienced by its rider, and never made any effort to get rid of it, but appeared to me to go on contentedly carrying it as long as the *Laelaps* chose to stay. This mounting and riding upon the Ants seemed to me very characteristic of the Gamasid, and I have utilized it for the specific name. The *Laelaps*

¹ "Acari, Scorpioni e Miriapodi Italiani." Florence, fasc. lviii. pl. iv.

was fairly common in the nests of *T. cæspitum*, but I never met with it elsewhere.

These were the only Gamasids which we found in the nests of *T. cæspitum*.

Another Ant whose nests were very common under the stones in the same place was *Aphænogaster testaceopitosa*, a somewhat larger and almost black species. In its nest we found another *Laelaps*, which I believe to be unrecorded and propose to call *L. myrmophila*; this also is an active Arachnid, but its activity is not shown in springing on the Ant, I never saw one upon an Ant during all my searches: on the other hand, the Ant seemed to take considerable notice of the mite, and when the nest was disturbed I frequently saw the former pick up the latter in its mouth and carry it off to a place of safety, just as it did with its own pupæ and larvæ, and as Ants are said to do with some of the beetles which frequent their nests. This Gamasid was tolerably common in the nests of the *Aphænogaster*, but I did not ever capture it elsewhere. So strictly were the three species found in Corsica confined to the nests of the respective Ants that when I saw the species of Ant I could tell at once what Gamasids I was going to find. I did not see any species except *L. myrmophila* in the nests of the *Aphænogaster*, nor did I obtain any Gamasids from the nests of such other species of Ants as I was able to search in Corsica.

After leaving Corsica I crossed Italy and spent the summer at Igls, a small village about 1100 feet above Innsbruck. The slopes of the Patcherkofl, upon which the hamlet stands, are clothed with pine and fir woods; and amongst them ants' nests abound. I had considerable opportunities of searching them; I, however, did not find there the same species of Ants as in Corsica, nor did I see any specimen of either of the three Gamasids which had inhabited their nests; on the other hand, we did find other Gamasids in the nests of other Ants.

In the first place, Mr. M. J. Michael brought in some specimens of a largish Gamasid which he had found in the nest of some ants in the ground; this creature also seems to be unrecorded, and I propose calling it *Laelaps levis*. Unfortunately my cousin, expecting to find plenty more, did not secure specimens of the Ant; so that I cannot say what species it associates with, for we were not successful in finding it again. I therefore only know that it was found in an ants' nest and that it does not appear to have been found elsewhere.

One of the commonest Ants was *Camponotus herculeanus*, a large species which amongst other habitats seems specially partial to the stumps of pine-trees which are left in the ground after the trees have been felled. These stumps, both above and under ground, are constantly riddled by the passages and chambers of the Ants, and such nests, which I believe were made by race *ligniperdus* of the Ant, proved perfect store-houses of Gamasids: not that every nest contained Gamasids, far from it; in many nests I could not find one; but in a considerable proportion of them the Arachnids were present in substantial numbers, although not usually in great abundance, all of

them belonging to one of the same two genera, viz. *Laelaps* or *Uropoda*, and, as far as I have been able to ascertain, none of them are yet known to science. The most frequent and the most conspicuous of the former genus was a pyriform species which had its dorsal surface dotted at almost regular intervals with wedge-shaped hairs, which give it rather an exceptional appearance; I propose calling it *L. cuneifer*. This Acarus was found chiefly deep in the interior of the nest, on the sides and roofs of the passages and chambers, where they were damp without being wet, although sometimes in dry parts, but never in any instance did I find this *Laelaps* on the Ants themselves. The *Laelaps* were of both sexes and in all stages; but even the immature stages of the mite were always on the wood, never on the Ant; yet I never found a specimen except in the Ants' nests. The same remarks will apply to all the Gamasids of the genus *Laelaps* which I found in the nests of the *Camponotus*.

I thought that this species would be a favourable one to experiment upon, in order to see if I could obtain any idea of the object for which the Gamasid was present in the Ants' nest. In these *Gamasinae*, when the dorsal chitin is thin, as in this species, the principal portions of the alimentary canal, consisting chiefly of the small ventriculus and its four great cæca, can be plainly seen through the dorsal surface as dark objects when they are full of food; if, however, they are empty they usually become invisible. I collected several suitable specimens of the Gamasid and placed them in the cells which I had formerly used with success in rearing *Gamasidae* under observation to trace their life-histories—viz. glass rings cemented on to an ordinary 3 × 1 inch microscopic glass-slip, and with the bottom of the cell thus formed lined with blotting-paper, which is kept moist, and a few pieces of suitable sterilized débris placed in the cell; the whole is then covered with a second glass-slip, and two elastic bands or a clip added to hold all together. The Gamasids were healthy when I put them in and their alimentary canals were full of food; I placed some living Ants with them and kept them supplied with living Ants only. The alimentary canals of the Gamasids soon ceased to contain food, and were not replenished, while the creatures themselves became weak and unhealthy. I changed my Gamasids, but with similar results. I then tried eggs, larvæ, and pupæ of the Ants; but in no case, as far as I could see, did the Gamasids touch them, and their alimentary canals became or remained empty as in the former case. This probably was only what might have been expected, as the Ants would hardly have tolerated in their nests creatures which destroyed themselves or their young; for such a Gamasid as *L. cuneifer* would not apparently have any means of defence against so powerful and well-armed an insect as *Camponotus herculeanus*. I now tried the experiment of killing adult Ants and putting their fresh dead bodies into the cells; very shortly the alimentary canals of all the Gamasids became well-filled, and the creatures strong and healthy. I thought, however, it would be better to avoid any possibility of mistake about this; so I removed the dead Ants and allowed the canals of the Gamasids

to become empty once more. I then placed in the cells some dead Ants which I had soaked in carmine stain; the next morning the alimentary canals of the Gamasids were all bright red, while the rest of their bodies was uncoloured. I repeated this several times with the like result, and on one occasion when a very clear Gamasid, which had lately changed from the nymph, had been supplied with a stained Ant and the cell then removed to the stage of the microscope, I saw the Gamasid mount on the body, plunge its trophi into it, and then I could plainly see the small streams of carmine liquid passing down the canal as the Gamasid sucked, and I afterwards dissected out the alimentary canals of some of the Gamasids and found them filled with red matter; the ordinary contents of course are not of that colour. These Gamasids would undoubtedly feed on the dead body of any small freshly-killed insect which might be found in the nest. The Gamasid hereinafter referred to as *Laelaps vacua* I also found would feed and thrive on the dead Ants, &c.; but *Laelaps acuta* I could not get to feed in a similar manner, and it did not live long in the cells. The above facts made it seem probable to me that the *Gamasinæ* were present either as scavengers, or else for the purpose of sharing the feast in the case of small insects killed by the Ants; possibly the friendly conduct of the Ants points rather to the former than the latter conclusion.

In the nests of the same Ant I found three smaller species of *Laelaps*, none of which I could find elsewhere, and which, as far as I know, are unrecorded; I propose calling them *L. flexuosa*, *L. vacua*, and *L. acuta*. The first-named is in one respect a singular creature, viz., as regards the mandible of the male. The mandibles of the *Gamasinæ* and *Uropodinæ* are usually chelæ; very retractile, and capable of being wholly withdrawn within the body. The two arms of the chela are often different, particularly in the male, one arm, oftenest the movable, having frequently some appendage or other complication, often of very strange form, but both arms are almost always directed forward. In the present species the fixed arm is most minute, a mere spike, while the movable arm is very long, horn-like, and doubly curved and undulated, both perpendicularly and laterally; so that the two mandibles cross and cannot be withdrawn into the body (fig. 6 a).

In the nests of the same Ant, *Camponotus herculeanus*, I also found a handsome bright-crimson *Uropoda* belonging to the section with sculptured backs; it was present in large numbers in one nest, and in small numbers in one or two others, and was found on the walls of the passages and chambers, and also, most abundantly, on the outside of the cocoons of such pupæ of the Ant as were enveloped in a cocoon; there were often three or four *Uropodæ* on a single cocoon. I could not ascertain that the cocoons were in any way injured, but the *Uropoda* appeared to get a thread or two of the cocoon loose, and this it held on to firmly, as well as I could ascertain, by holding it with the flattened femora of the first pair of legs. I never found any of the *Uropodæ* either upon the adult Ants or their larvæ or upon such pupæ as were not enclosed in a cocoon.

I did not find this *Uropoda* in the nests of any other Ant, but Mr. Bostock has since found it in England in the nests of *Formica fusca*, where also it is found on the cocoons and in the nest.

There was one very good nest of *Camponotus herculeanus*, nearly a thousand feet above Igls, which I kept as a kind of store-house for some time; the tree had been cut down near the ground and the greater part of the stump was beneath the surface or beneath the fallen débris of the forest. I used to dig and cut down into the centre of this nest, take home parts for examination, and carefully put back and cover up the remainder. In this way I kept the Ants in it for some considerable time, and as long as the Ants remained the Gamasids were to be found there; but at last the Ants seemed to get tired of being so frequently disturbed, at any rate they abandoned the nest, and from that time the Gamasids vanished also. I could not find any more. I also frequently examined other abandoned nests, but I never found the Gamasids in them except possibly a single specimen once or twice.

It will thus be seen that I have found seven species of *Gamasinæ* and two of *Uropoda* in Ants' nests (one species previously found by Berlese), and that two other species have been found by others; that none of these have been found elsewhere; and that, so far as has been ascertained, each Gamasid was associated with one or two particular species of Ants only.

I did not find any other Acarina in the nests except a few Oribatidæ, which were in much larger numbers on other stumps where the Ants were not present.

From the above observations I come to the following conclusions:—

1. That there is an association between various species of *Gamasinæ* and certain Ants.
2. That one species of Gamasid usually associates with one or two special species of Ant only, or at least preferentially, although this may be a little affected by the presence or absence of the Ant in different localities.
3. That the Gamasids found in Ants' nests are not usually to be found elsewhere, except probably rare and scattered specimens on careful search.
4. That the Gamasids usually abandon the nest if the Ant does so.
5. That the Gamasids live upon friendly terms with the Ants, who do not attack them and even show signs of taking care of them.
6. That the Gamasids are not true parasites and do not reside upon the bodies of the Ants.
7. That, in the cases investigated, the Gamasids do not kill or injure the Ants or their young.
8. That the Gamasids will eat the dead Ants.
9. That the *Gamasinæ* are not improbably either scavengers or else messmates sharing the feast off any insects which the Ants may kill.
10. That we do not know what the *Uropodinæ* feed on nor the object of their presence in the nests.

UROPODA COCCINEA, n. sp.¹ (Plate XLIX. figs. 1-1*f*.)

	♀	♂
	millim.	millim.
Length, about	·78	·75
Greatest breadth, about ..	·58	·51

This species somewhat resembles *Uropoda festiva*, Berlese, from Paraguay and, less closely, *U. lamellosa* of the same author (ex Canestrini).

Colour deep crimson in living specimens, after death this fades to a reddish brown or sometimes to a yellowish brown.

Texture very rough and dull.

Shape nearly elliptical, but with the dorsal plate projecting over the rostrum as a narrow plate bent sharply downward and slightly bifid at the distal end.

From the rostral projection a thin undulated lamina runs along each side of the body; it is slightly translucent, widest anteriorly, finely granulated and striated, and strongly bent downward between the second and third pair of legs. Above and within this lamina are two rough and dark, projecting, concentric, chitinous ridges, the inner considerably above the outer; between them is a broad, almost concave, finely granulated band widest at the sides. Within the inner ridge is a plain space slightly granulated, then the back rises sharply from each side toward the median line, which, however, is not an edge or ridge, but is rounded. The raised portion is divided by a deep, irregular, transverse sulcation about two thirds of the way back, which, however, does not reach the median line; thus the two parts of the raised centre are joined by a broad longitudinal joining-piece. The raised parts are not smooth, but each has a very slightly raised space occupying its central portion; the anterior of these is somewhat seven-lobed and the posterior more four-lobed; both are indistinctly marked out and covered by raised, rough, dark broken ridges and lumps, all very irregular and never quite alike in two specimens or on the two sides of the same specimen; amongst these markings six great rounded pieces, which border and project into the transverse sulcation, are much the strongest and darkest. Between all these markings the chitin is granulated but more finely. There are not any hairs on the body.

Mandibles (fig. 1*b*) very minute, those of male without the pointed spear-like end usual in the genus; each arm of the chela simply bidentate. Palpus with two large spines on the basal, and one on the penultimate joint, besides numerous smaller spines and hairs; one hair on the terminal joint is very large. Epistome (fig. 1*c*) long and very pointed, with a few spines near the middle. Hypostome (maxillary lip) (fig. 1*f*) with the two sides (maxillæ) not fused, the outer part of each (galea of Mégnin) of the ordinary type, the inner part (lacinia) a dense brush of long fine hairs. Epipharynx (fig. 1*d*) triangular, fringed and strewn with fine short hairs. This

¹ If Prof. Berlese's genus of "*Trachyuropoda*" be adopted, this species should be included in it.

organ is often drawn as the lingua and occasionally, I fear, as the epistome, whence great confusion arises; it would bear almost the same relative position to the epistome as in the two figures if seen from below, but the epistome would not advance so far beyond it.

Ventral surface rough, deeply excavated for the reception of the legs, and with numerous strong ridges. There is a singular round chitinous projection, surrounded with a strong rough edge, in the median line between the coxæ of the 4th pair of legs in both sexes, with a deep pit on each side of it. Genital plate of female straight behind, rounded anteriorly, extending from a little in front of the 4th coxæ nearly to those of the first pair. That of the male of the ordinary form and position. All the legs furnished with claws and caruncles.

Hab. Very numerous in one nest of the wood-boring Ant *Camponotus herculeanus* (probably race *ligniperdus*) near Innsbruck, Tyrol, and a few in other nests of the same Ant in the same place. Mr. E. Bostock has since found it fairly abundant in the nests of *Formica fusca* at Buxton, Derbyshire.

LÆLAPS CUNEIFER, n. sp.¹ (Plate XLIX. figs. 2-2*f*.)

	♀	♂
	millim.	millim.
Length, about	·77	·64
Greatest breadth, about . .	·60	·47

Colour dull yellow-brown or bay, the specimens vary in depth of tint from light to quite dark.

Texture fully chitinized, smooth but not polished; the whole body covered with irregular reticulations averaging about 25 to 50 to the millimetre, caused by fine raised chitinous ridges. No other markings.

Shape pyriform, very slightly truncated in front, rounded posteriorly. The whole body much arched on the dorsal surface.

Mandibles of male (fig. 2*b*) with the fixed arm of the chela having a bifid or bidentate end, but not otherwise dentate. Movable arm strongly recurved at the distal end, and with a long, chitinous, curved, accessory piece projecting beyond the principal part of the chela. Epistome (fig. 2*c*) hyaline, almost rounded, but with a slight tendency to a median point, the whole anterior edge set with sharp points, of which one on each side is somewhat longer than the others. The whole dorsal surface set with short, cuneiform, slightly curved hairs (fig. 2*f*) at almost equal distances, about 10 to 15 to the millimetre; these also surround the periphery.

Ventral surface of the female (fig. 2*a*) with anal plate small and spade-shaped; genital plate large, with a semitransparent, rounded, anterior edge overlapping the sternal plate. Peritreme conspicuous, almost straight. The plates on the ventral surface are composed of

¹ According to Professor Berlese's latest classification, although not according to his former ones, this species and the others of the same genus in this paper would probably be considered as belonging to the genus "*Sejus*." I have not thought it wise to adopt this view.

irregular divisions, mostly scale-like in form and varying greatly in size, every division has a crinkled edge. Legs in both sexes without apophyses or projections, first pair considerably the thinnest, all legs terminated by claws and long-shaped caruncles with five anterior points (fig. 2 *e*); on the front pair of legs the claws and caruncles are attached to the end of a rod-like projection of the tarsal joint (fig. 2 *d*). This is common in the *Gamasinae*, but is much developed in this species.

Hab. Considerable numbers found in the nests of *Camponotus herculeanus* (probably race *ligniperdus* and other varieties) near Innsbruck, Tyrol.

LÆLAPS LÆVIS, n. sp. (Plate XLIX. figs. 3–3 *b*.)

	♀ millim.
Length, about	1·1
Greatest breadth	·72
Length of legs, 1st pair, about . .	1·12
" " 2nd " " 	·72
" " 3rd " " 	·72
" " 4th " " 	1·0

Colour lightish chestnut.

Texture fully chitinized, highly polished, entirely without markings.

Shape a long ellipse, almost parallel-sided; slightly rounder posteriorly than anteriorly; much arched on the dorsal surface.

Mandibles of male (fig. 3 *a*).—The fixed arm of the chela has a bifid or bidentate termination, but is not otherwise dentate. Movable arm only slightly recurved at the distal end, and with a single small tooth in addition to the terminal point; it also has a long, slender, slightly curved, and undulated tri- or quadri-dentate accessory piece, with a singular slightly knobbed end with a spike directed backward; it projects considerably beyond the principal portion of the chela. Epistome (fig. 3 *b*) hyaline, indented at a very obtuse angle at each side, and projecting in an obtuse angle, almost a curve, in the centre, the whole edge serrated, the serrations strongest just behind the points of the side angles. There are a few extremely minute white hairs on the dorsal surface, so small as to make it quite impossible to depict them in a drawing on the scale of fig. 3.

Underside of female with anal plate small, spade-shaped; genital and ventral plates fused, the former with a rounded anterior edge, not quite touching the sternal plate. Ventral plate not quite touching the anal. Stigma between the third and fourth legs; peritreme slightly undulated. Legs in both sexes without apophyses. All legs terminated by claws and long-shaped caruncles.

I am not able to give the measurements of the male. I only found one specimen, which I unfortunately dissected before I found out that it was the only example.

Hab. A few found in the nests of ground-ants (species not known) near Innsbruck, Tyrol.

LÆLAPS MYRMOPHILA, n. sp. (Plate XLIX. figs. 4-4 b.)

	♀	♂
	millim.	millim.
Length, about	·68	·66
Greatest breadth, about	·52	·42
Length of legs, 1st pair, about..	·52	·50
" " 2nd " " ..	·46	·30
" " 3rd " " ..	·39	·31
" " 4th " " ..	·62	·57

Colour lightish chestnut-brown.

Texture highly polished, entirely without markings.

Shape inversely oval, *i. e.* the larger end forward; the anterior margin projects *very* slightly above the rostrum, but this projection is rounded. The hinder part of the body is much more attenuated than the front part. The female is considerably wider in proportion than the male, but still diminishes to a rounded point behind. Dorsal surface considerably arched, particularly the anterior and central portions.

Mandibles of male (fig. 4 a) have the fixed arm of the chela greatly curved near the end, which forms a strong tooth; there is another large tooth close behind, and a much smaller one further back; the movable arm also ends in a strong curved tooth, just opposite that of the fixed arm, and has one other strongish tooth. Attached to the side of this arm is a large appendage, which is as thick as the arm and projects beyond it; it is of about equal breadth until near the distal end, then it suddenly diminishes and has a very small bifid termination. Epistome (fig. 4 b) almost five-sided, the median side very short, with a small point at each end directed forward; the whole anterior portion of the epistome is edged with very fine points or teeth. There are a few extremely fine and small white hairs on the dorsal surface, too small to be depicted in a drawing on the scale of the figure; one pair, however, near the posterior end are considerably larger, although still small.

The under surface of the female has the plates arranged in a manner similar to that figured in *Laelaps cuneifer*.

Legs in both sexes without apophyses; all legs terminated by claws and caruncles.

Hab. Found commonly in the nests of *Aphænogaster testaceopitosa*, Luc., near Ajaccio, in Corsica.

LÆLAPS EQUITANS, n. sp. (Plate I. figs. 5-5 b.)

	♀
	millim.
Length, about	·62
Greatest breadth, about	·50
Length of legs 1st pair, about..	·50
" " 2nd " " ..	·29
" " 3rd " " ..	·31
" " 4th " " ..	·38

This species has more resemblance to *Laelaps hilaris*, Koch, than

to any other with which I am acquainted; it is decidedly different from it. *L. hilaris* is a parasite of the Mouse.

Colour light yellow-brown or bay.

Texture fully chitinized, smooth, almost, but not really, polished. The whole dorsal surface is covered with fine irregular reticulations, which are much longer in the direction across the body than in that from rostrum to posterior end; their length in the former direction averages about twelve, and in the latter about fifty to the millimetre. No other markings.

Shape subdiscoidal, but not actually so. The dorsal plate projects slightly over the rostrum; the greatest breadth is about an eighth less than the greatest length; the body is a trifle narrower posteriorly than anteriorly, and has a slight tendency to a rounded point posteriorly. The back is not strongly arched, the thickness in a dorso-ventral direction being small; it is, however, much greater in the anterior than the posterior part of the body.

Mandibles of male.—I only found one adult male, and dissected this specimen; but the mandibles being very small and delicate, I unfortunately broke them before I could see them clearly. Fig 5 *b* is a representation of the broken organ, from which I conclude that, when perfect, it would greatly resemble that of *Laelaps vacua* (fig. 7 *a*).

The whole dorsal surface is set with long, rather thick and conspicuous hairs, placed at almost regular intervals, but not exactly in rows. Ventral surface of female with ventral and genital plates united, the latter rounded anteriorly. The ventral plate large, almost touching the anal plate. Legs without apophyses, first pair much the longest, all terminated by claws and caruncles. Fourth pair set far forward, and in life usually held almost perpendicularly, and thus concealed beneath the body.

Hab. Found commonly, but not abundantly, in the nests of *Tetramorium caspium*, race *meridionale*, Emery, near Ajaccio in Corsica, frequently riding on the heads of the Ants.

All those which I found, with the single exception above noticed, were females. I never saw one with mature eggs in it, and from this circumstance I doubted whether they were adult; they were, however, larger than the male, which certainly was adult, and they had the exterior genital opening well developed. I unfortunately was not aware that the male was the only specimen when I dissected it, and therefore I omitted to measure it.

LÆLAPS FLEXUOSA, n. sp. (Plate L. figs. 6–6 c.)

	♀	♂
	millim.	millim.
Length, about	·53	·40
Greatest breadth, about	·32	·24
Length of legs, 1st pair, about. .	·40	·33
" " 2nd " " ..	·27	·24
" " 3rd " " ..	·25	·26
" " 4th " " ..	·43	·39

Colour light yellow-brown or bay.

Texture fully chitinized, except as mentioned below; smooth but not polished; the whole of the dorsal plate is covered with very fine irregular reticulations, which are slightly longer in a direction across the body than in that from rostrum to posterior end; in the former direction they average about 35 to the millimetre. They are difficult to see. No other markings.

Shape almost elliptical, rather more pointed posteriorly than anteriorly.

The chitinated dorsal plate does not cover the whole of the body, but allows a considerable space of white flexible cuticle to be seen at the hinder end; this cuticle, if seen by a sufficient amplification, is found to be finely striated in a transverse direction.

The mandibles of the male (figs. 6 *a*, *b*, *c*) are the remarkable feature of the species; the fixed arm of the chela is merely a very minute straight spike; the movable arm is a long, slender, round horn, not toothed, but doubly undulated, curving downward and across the body; thus the two movable arms cross, and consequently the mandibles cannot be retracted within the body, as those of the Gamasidæ usually can. The whole dorsal surface is set, at nearly regular intervals, about 30 to the millimetre, with spine-like hairs, which gradually increase in length from the anterior to the posterior end of the body; those at the rear are more than twice as long as the anterior ones. Ventral surface of female as in *L. cuneifer*. Legs without apophyses, all terminated by claws and caruncles.

Hab. Found in the nests of *Camponotus herculeanus* (probably race *ligniperdus*), near Innsbruck, Tyrol, but rare.

The nearest ally of this species would seem to be the *Stilochirus rovennensis* of Canestrini.

LÆLAPS VACUA, n. sp. (Plate L. figs. 7-7 *b*.)

	♀	♂
	millim.	millim.
Length, about	·53	·49
Greatest breadth, about	·31	·29
Length of legs, 1st pair, about. .	·44	·41
" " 2nd " " ..	·32	·34
" " 3rd " " ..	·29	·30
" " 4th " " ..	·44	·41

Colour light yellow-brown or bay.

Texture fully chitinized, smooth but not polished, divided into small, mostly almost hexagonal reticulations; no other markings.

Shape rather shield-shape, sharply cut in front of shoulder, which is the broadest place; the width of the body diminishing towards the posterior end, particularly in the male. Dorsal surface considerably arched.

Mandibles short, those of male (fig. 7 *a*) have the fixed arm of the chela nearly straight for three quarters of its length, then suddenly bent downward so as to form a very large, straight, terminal

tooth. There is a single small tooth just behind this. Movable arm nearly straight on the inner edge, with a large, strongly-curved, terminal tooth, and a smaller recurved one a short distance behind it. This arm has a long, slender, round, and undulated accessory piece on its outer side, which projects considerably beyond the rest of the chela. Epistome (fig. 7 *b*) rounded, serrated with small teeth. The dorsal surface is set with smallish, spine-like hairs, at almost regular intervals (about 25 to the millimetre).

The under surface of the female has the plates arranged similarly to those of *Laelaps cuneifer*. The legs are sharply bent at the femora, which makes the measurements of them rather imperfect, they are also much curved; the second and fourth pairs are considerably thicker than the first and third, especially in the male. The tarsi of these legs in the male end in a curious human-foot-like turn, most marked in the fourth leg. The femora of these two legs have two somewhat wedge-shaped hairs on their outer side, the other hairs are mostly fine spines. No apophyses to any leg; all legs terminated by claws and caruncles.

Hab. Found in the nests of *Camponotus herculeanus* (probably race *ligniperdus*), near Innsbruck, Tyrol. Rather common.

LÆLAPS ACUTA, n. sp. (Plate L. figs. 8-8 *b*.)

	♀ millim.	♂ millim.
Length, about	·71	·56
Greatest breadth, about	·46	·32
Length of legs, 1st pair, about . .	·62	·52
" " 2nd " " . .	·42	·36
" " 3rd " " . .	·40	·37
" " 4th " " . .	·70	·61

Colour lightish chestnut.

Texture fully chitinized, highly polished. With a highish power and a strong light it is seen that the dorsal surface is marked out by very fine lines into irregular, mostly hexagonal or pentagonal, divisions averaging about 25 to the millimetre across the body, and about 50 to the millimetre in an antero-posterior direction. No other markings.

Shape rather narrow anteriorly, more truncated or rounded posteriorly; the sides markedly curved, widest a little in front of the middle. Moderately arched on the dorsal surface.

Mandibles of the male (fig. 8 *a*) very singular; fixed arm of the chela of the ordinary type, rather straight, with a short, sharp, recurved termination, two other teeth not large. The movable arm is much the larger, nearly twice as long as the fixed arm, and much broader; it has a large and a small tooth, near together, about the middle, and a long and sharp upwardly curved end; what appears to be a small channel or duct runs almost its whole length in the interior. No accessory piece. Epistome (fig. 8 *b*) rounded, dentate, the middle teeth considerably the longest. The dorsal surface is set

with regularly spaced fine hairs, about .07 mm. long and about .03 mm. apart (transversely). Ventral plates as in *L. laevis*. Legs without apophyses, and all terminated by claws and caruncles. The femora with one or two small spines, the other joints with a few fine hairs.

Hab. Not uncommon in the nests of *Camponotus herculeanus* (probably race *ligniperdus*) near Innsbruck, Tyrol.

EXPLANATION OF THE PLATES.

PLATE XLIX.

- Fig. 1. *Uropoda coccinea* ♀, dorsal aspect, ×65, see p. 646.
 1 a. " " ♀, ventral aspect, ×65.
 1 b. " " ♂, mandible, ×650.
 1 c. " " epistome, ×300.
 1 d. " " epipharynx, ×300.
 1 e. " " palpus, side view, ×220.
 1 f. " " hypostome, ×300.
 2. *Laelaps cuneifer* ♀, dorsal aspect, ×55, see p. 647.
 2 a. " " ♀, ventral aspect, ×30.
 2 b. " " ♂, mandible, ×250.
 2 c. " " ♀, epistome, ×170.
 2 d. " " end of tarsus, 1st leg, ×120.
 2 e. " " claw and caruncle, ×350.
 2 f. " " two of the wedge-shaped hairs from the dorsal surface, ×350.
 3. *Laelaps laevis* ♀, dorsal aspect, ×35, see p. 648.
 3 a. " " ♂, mandible, ×175.
 3 b. " " epistome, ×120.
 4. *Laelaps myrmophila* ♂, dorsal aspect, ×55, see p. 649.
 4 a. " " ♂, mandible, ×190.
 4 b. " " epistome, ×220.

PLATE L.

5. *Laelaps equitans* ♀, dorsal aspect, ×50, see p. 649.
 5 a. " " ♀, ventral aspect, ×50.
 5 b. " " ♂, part of mandible (broken, see descriptions), ×750.
 6. *Laelaps flexuosa* ♀, dorsal aspect, ×75, see p. 650.
 6 a. " " ♂, the two mandibles and palpi *in situ*, seen from above, ×300.
 6 b. " " ♂, one of the mandibles seen from the side, ×300.
 6 c. " " same mandible from below, ×300.
 7. *Laelaps vacua* ♂, dorsal aspect, ×75, see p. 651.
 7 a. " " ♂, mandible, ×700.
 7 b. " " epistome, ×350.
 8. *Laelaps acuta* ♀, dorsal aspect, ×45, see p. 652.
 8 a. " " ♂, mandible, ×500.
 8 b. " " epistome, ×220.

4. Notes on the Bornean Rhinoceros. By EDWARD BARTLETT,
Naturalist to the Government of Sarawak.

[Received October 29, 1891.]

Four heads and three horns of the Rhinoceros of Borneo are in the Museum at Kuching, Sarawak, of which I send the following details and photographs:—

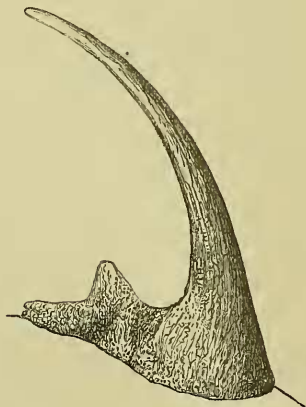
1. Head with the skin still on it.

Length of head, from front of nose to centre of coronal ridge of skin, $19\frac{1}{2}$ inches; across forehead to corner of eyes $7\frac{3}{4}$ inches; tip of upper lip to corner of mouth $6\frac{1}{4}$ inches; front horn $4\frac{1}{2}$ inches; hind horn 2 inches long. (No. 1 in the photograph.)

2. Head partly covered with skin. Horn 5 inches long; the hind one is merely a round knob. The skull is of about the same size as the first. (No. 2 in the photograph.)

3. Skull only: measures 20 inches from the tip of the nasal bones to the coronal ridge; forehead from eye to eye $5\frac{3}{4}$ inches; lower jaw $16\frac{1}{2}$ inches. (No. 3 in the photograph.)

4. Skull only: from nasal bone to coronal ridge $20\frac{1}{2}$ inches; forehead between the orbits $6\frac{1}{3}$ inches; lower jaw 17 inches. (This skull is not figured in the photograph.)



Horns of *Rhinoceros sumatrensis*, no. 5. (From a photograph.)

5. Two horns on skin of the upper part of the head. Front horn $19\frac{1}{8}$ inches; the second horn is well developed. The base of the front one is 16 inches in circumference. (No. 4 in the photograph.)

6. Single horn 11 inches; circumference of base $11\frac{1}{2}$ inches. (No. 5 in the photograph.)

7. Single horn 6 inches; circumference about 9 inches. (No. 6 in the photograph.)

Skull No. 3 resembles in every respect one which is in the possession of my father (Mr. A. D. Bartlett), which I remember perfectly well, although without particulars. My memory tells me that my father's specimen appeared as though it had been burnt over a fire, exactly like Nos. 3 and 4 above mentioned. The Dyaks roast these animals for food.

The specimen No. 5 in the photograph is similar to the one in my father's possession. The prominence for the second horn is scarcely visible, hence the doubt formerly expressed respecting its belonging to a single- or a two-horned Rhinoceros.

The above-mentioned skulls and horns came from the jungle regions of the upper Rajah River, inhabited by the Kyans, a dangerous race of people, very distinct from the Dyaks. These Kyans procure the horns for barter, for which they receive a high price from the Chinese, who import them to China for medicine. The horns are ground into powder for some diseases, while others are cut into minute fragments to carry about the person.

The general appearance of this animal (judging from the two heads with skin attached) is similar to that of the Sumatran species (*Rhinoceros sumatrensis*)¹. It is perfectly black, covered with short black bristles; the ears are short and covered with short black hair without fringe (unlike *R. lasiotis*).

The Rhinoceros is becoming extremely rare in the Province of Sarawak, on account of the value set upon the horns, but in Central and North Borneo in the very old jungle it is more plentiful. I have heard that two species exist; but this, I think, is doubtful.

5. Notes on the Lemming (*Myodes lemmus*).

By T. T. SOMERVILLE, of Oppegarde, Christiania².

[Received August 10, 1891.]

Very little appears to be authentically known of the exact habitat of the Lemmings, and they seem scarcely ever to be observed except upon the occasion of their great migrations. Their home is probably confined to the great table-lands, at an altitude of 3000 feet or more, on the mountains of Central Norway, and further north on the ranges between Norway and Sweden. Indeed ancient writers asserted that the sudden appearance of Lemmings was due to their being showered from the clouds, and even to this day there are many worthy peasants who are at a loss for any other explanation. Certain it is that for indefinite periods, of from four or five up to, perhaps, twenty years, the Lemming is never seen in the inhabited parts of the country, and then suddenly appears in countless hordes

¹ Cf. Flower, P. Z. S. 1880, p. 69.

² [Along with the present communication we received from Mr. Somerville seven living examples of the Lemming for the Meuserie. Of these two are still living; the other five died on the following dates:—(1) Aug. 20, 1891. (2) Aug. 31, 1891. (3) Oct. 19, 1891. (4) Nov. 7, 1891. (5) Nov. 27, 1891.—P. L. S.]

over whole provinces. Usually the mountain-pastures and high-lying farms are the first to suffer, and it is positively asserted that the crops on such farms have been entirely eaten off, and that even in the more generally cultivated valleys the loss to the farmers is frequently very serious.

The numbers that take part in these migrations have been estimated at many millions, and there are most extraordinary stories told to show how, on these occasions, the Lemming-host goes straight forward, climbing over or burrowing under every obstacle and never diverging from its course. How far these stories are reliable we will not venture to consider, but it is quite certain that the Lemmings unhesitatingly attempt to cross streams too rapid and lakes too wide for them to swim across, and that they tumble into holes, wells, and brooks, the sides of which are too steep for them to scramble out of again, so that, frequently, people are at a loss to obtain water that is not polluted by their bodies. Doubtless this accounts for an epidemic, popularly termed "Lemming fever," that is said to prevail after the migration and which is described as resembling ordinary typhoid.

The Lemmings never return from their exodus. Those that reach the coast alive are said to swim straight away to sea; and this may be the case on the west coast, towards which, naturally enough from the geographical formation of the country, the majority direct their march. On the coast-line between Christiania and the southernmost point the Lemmings are certainly not always so precipitate, but, occasionally at least, spend weeks or months before taking to the water or being cut off by battle or disease. When they do begin to disappear, it is not many days before they are no longer to be met with alive, while the number of dead bodies to be seen everywhere, both on land and along the shores of lakes, rivers, and fjords, proves that they have not "melted into thin air," in whatever manner they may have come into the country.

Personally we can date our acquaintance with the Norwegian Lemmings back to the autumn of 1872, when we were grouse-shooting on the mountains around the celebrated Rjukan Foss in Telemarken. Upon that occasion we captured a number and succeeded in finding four that lived harmoniously together, and which became very tame during the two or three weeks we had them. We thought of presenting them to this Society, but they were unfortunately drowned on our passage down the lake Tinsö.

In 1876 we found, on getting to Norway in the month of April, that the whole coast, at all events from the Christiania fjord to Christiansand, swarmed with Lemmings that had descended during the previous autumn. One gentleman told us that in the town of Arendal, the first thing to be done every morning was to collect the bodies of Lemmings in the streets and in the courtyards of the houses that had been killed by cats during the night. In the courtyard of his own dwelling he had counted up to twenty-seven dead Lemmings one morning.

We found the same state of things further north. Under almost

every juniper bush and under every suitable rock or big stone were the signs of the Lemmings which had their burrows beneath, and even the towns were full of them. We had no difficulty in catching about a dozen, of which we placed three or four in each of as many empty bird-cages. Next morning all or almost all were dead. Many or most had wounds in the throat. We repeated our attempts to preserve some, but they either died or were killed by each other. We were told that, at this season especially, these animals fought desperately, and that the usual result of each combat was the death of both parties. This appeared to be true. Moreover, we were assured that the *new grass*, with which we supplied our captives, invariably caused the death of all the Lemmings. This belief we have subsequently heard expressed most firmly in every part of the country, and there really seems to be some good reason for it. In the case in question the snow was disappearing fast, the new grass was beginning to shoot up, and in a very short time not a living Lemming remained anywhere. It seems that the Lemmings when they reach the coast frequently spend the winter there, but when the spring sets in they all die. Professor Collett, of the Christiania University, cannot accept the theory of the new grass causing the death of the Lemmings, but asserts that this is due to a disease such as always appears when animals multiply to an abnormal extent and which he cannot believe is caused in any way by the grass.

In 1887 we again came across some Lemmings on the mountain-plateau beyond the Rjukan Foss, and we secured a couple. These, however, escaped when we were on our way home, by gnawing through the box in which they were placed, and we were unable to get others.

Towards the end of June this year we found Lemmings in great force on the mountains around the "Gausdal Sanatorium," a hydro-pathic establishment situated about 2500 feet above the sea within a day's journey from Christiania. We were informed that a few weeks earlier there had been hundreds for every one remaining; and this was easy to believe, for the number of dead bodies was in many places very great. There were, however, still so many that it was scarcely possible to walk for an hour without seeing several.

On the 13th of July we secured a Lemming which, although apparently not full-grown, seemed likely to have little ones. She was from the first unusually docile, and appeared much satisfied with the arrangements made for her. We had thoroughly scraped and washed a cigar-box, lightly filled it with moss, made an entrance-hole and a couple of ventilators, and fastened down the lid; this we placed in her box while a more elaborate dwelling was being prepared. Next day, 14th July, when about to transfer the Lemming to the new box, we found that she had given birth to six little ones. These were naked, pink, blind, and very ugly little wretches with huge heads. The moss in the cigar-box had been formed into a sort of round nest, and a quantity of paper, torn to fine shreds, formed the lining, in the centre of which were the young. That day

and the next the mother was scarcely ever in the cigar-box, and we feared that she had deserted the nest, but on looking in on the third day the little ones were seen to be alive. We had the pleasure next day of examining one of the little ones that had come out of the cigar-box; it was quite blind and unable to walk, it could only scratch and kick and roll over, and it was still quite naked but that a sort of silky shade was doubtless the commencement of a coat. Still the little animal more resembled in texture a good fat caterpillar than a fur-bearing mammal. We noticed now distinctly how the skin was stained black precisely where the black markings would appear, and the ears, legs, and tail appeared to have made most progress since our former hasty glances. The mother let it remain for some time, when she took it in her mouth and carried it in. After that it frequently happened that one or two rolled out or were dragged out attached to the teat, and the mother always took them in again before very long. On the 21st July—the eighth day—the silky coats of the little ones began really to show nicely in their proper colours. They were still quite blind and were become exceedingly thin, long, and leggy; they began to run out and in a day or two later, and from the 24th July, the eleventh day of their age, would run about—still blind—in, over, and under the moss in the two apartments of their box, in one of which the cigar-box, occupying about a third of the compartment, formed their sleeping-chamber. Two days later (26th July) their eyes began to open a very little, and next day were fully open; they were now about the size of a common mouse, and they began to nibble at the moss and other eatables.

On the 29th July the mother died. We hope her six little ones are now able to do without her.

We should have mentioned that we had obtained, besides those specified as having escaped or died, four two-thirds grown Lemmings, three half-grown, and one enormous old female, the very largest we have seen, and which on the night of the 22nd July brought forth nine little ones. This interesting creature is most extraordinarily docile, allows our children to handle both herself and young, and does not even seem to object to the three half-grown Lemmings entering her box and her nest. These half-grown Lemmings we took one day from their nest; there were five, but the other two escaped. In the immediate neighbourhood was another nest in which were five young ones, but when we left Gausdal Sanatorium these were still too young to take.

We left Gausdal Sanatorium on the 23rd July with our nine Lemmings and fifteen young ones; these were carefully conveyed to Christiania, and some of them were subsequently forwarded to the Society.

APPENDIX.

LIST OF ADDITIONS TO THE SOCIETY'S MENAGERIE

DURING THE YEAR

1891.

- Jan. 6. 1 Peregrine Falcon (*Falco peregrinus*). Presented by A. C. Ionides, Esq.
7. 2 Virginian Foxes (*Canis virginianus*). Received in Exchange.
8. 1 Humboldt's Lagothrix (*Lagothrix humboldti*), ♂. Purchased.
9. 1 Starred Tortoise (*Testudo stellata*). Presented by W. J. Bosworth, Esq.
- 2 Toque Monkeys (*Macacus pileatus*), 2 ♀. Presented by W. J. Bosworth, Esq.
12. 2 Large Hill-Mynahs (*Gracula religiosa*). Deposited.
14. 1 Ring-tailed Coati (*Nasua rufa*), ♀. Presented by E. Hopkinson, Esq.
16. 1 Red Lory (*Eos rubra*). Purchased.
19. 1 Ring-tailed Coati (*Nasua rufa*), ♂. Presented by Cyril Smith, Esq.
20. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Deposited.
22. 2 Hawfinches (*Coccothraustes vulgaris*), 2 ♂. Presented by J. Newton Hayley, Esq.
- 2 Blood-breasted Pigeons (*Phlogœnas cruentata*). Presented by Wilfrid G. Marshall, Esq.
- 1 Chinese Turtle-Dove (*Turtur chinensis*). Presented by Wilfrid G. Marshall, Esq.
- 1 Yellow-crowned Penguin (*Eudyptes antipodum*). From Stewart's Island, New Zealand. Presented by Sir Henry W. Peek, Bart., F.Z.S. See P. Z. S. 1891, p. 121.
25. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Count Povoleri, F.Z.S.
- 4 Restless Cavies (*Cavia porcellus*). Presented by Count Povoleri, F.Z.S.
26. 1 Variegated Sheldrake (*Tadorna variegata*), ♀. Received in Exchange.
- 1 Red-necked Grebe (*Podiceps griseigena*). Presented by Thos. Hardcastle, Esq.

- Jan. 27. 1 Black-headed Lemur (*Lemur brunneus*), ♂. Deposited.
 1 American Bison (*Bison americanus*), ♂. Born in the Menagerie.
 2 Japanese Pheasants (*Phasianus versicolor*), ♂ ♀. Presented by E. Wormald, Esq., F.Z.S.
28. 1 Triton Cockatoo (*Cacatua triton*). Deposited.
 1 Milne-Edwards's Porphyrio (*Porphyrio edwardsi*). Purchased.
 1 Grey-headed Porphyrio (*Porphyrio poliocephalus*). Purchased.
30. 1 Indian Python (*Python molurus*). Received in Exchange.
 40 River Lampreys (*Petromyzon fluviatilis*). Presented by Mr. Thos. F. Burrows.
31. 2 Passerine Owls (*Glaucidium passerinum*). Presented by St. John Northcote, Esq.
- Feb. 4. 2 Common Peafowls (*Pavo cristata*), ♀. Presented by Rich. Hunter, Esq.
5. 1 Malbrouck Monkey (*Cercopithecus cynosurus*), ♂. Presented by J. P. Heseltine, Esq., F.Z.S.
 1 Malbrouck Monkey (*Cercopithecus cynosurus*), ♀. Presented by Mrs. Newton.
 2 Globose Curassows (*Crax globicera*), ♂ ♀. Deposited.
 1 Daubenton's Curassow (*Crax daubentoni*), ♂. Deposited.
 2 Mexican Guans (*Penelope purpurascens*). Deposited.
10. 6 Night-Herons (*Nycticorax griseus*). Presented by Mr. A. A. van Benmelen, C.M.Z.S.
11. 1 Spotted Eagle Owl (*Bubo maculosus*). Presented by Julius Wilson, Esq.
 2 Yellow-throated Rock-Sparrows (*Petronia petronella*). Deposited.
13. 1 Red Deer (*Cervus elaphus*), ♀. Presented by C. J. H. Tower, Esq., F.Z.S.
14. 1 Redwing (*Turdus iliacus*). Presented by Mrs. J. B. Capper.
 7 Knots (*Tringa canutus*). Purchased.
 2 Bar-tailed Godwits (*Limosa lapponica*). Purchased.
16. 1 Scaup (*Fuligula marila*), ♂. Purchased.
 1 Curlew (*Numenius arquata*). Purchased.
17. 2 Burbots (*Lota vulgaris*). Presented by Mr. T. F. Burrows.
18. 1 Jack Snipe (*Gallinago gallinula*). Presented by W. H. St. Quintin, Esq., F.Z.S.
 1 Common Buzzard (*Buteo vulgaris*). Presented by W. H. St. Quintin, Esq., F.Z.S.
 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Henry Williams, Esq.
19. 1 Green Monkey (*Cercopithecus callitrichus*), ♂. Presented by A. Mann, Esq.
 1 Grey Ichneumon (*Herpestes griseus*), ♀. Presented by J. Seymour Bartlett, Esq.
21. 1 Little Grebe (*Tachybaptus fluviatilis*). Presented by Miss E. Bartlett.
23. 1 New-Zealand Parrakeet (*Cyanorhamphus novæ-zealandiæ*). Received in Exchange.
24. 2 Wonga-Wonga Pigeons (*Leucosarcia picata*), ♂ ♀. Received in Exchange.
25. 1 Gayal (*Bibos frontalis*), ♀. Born in the Menagerie.
 1 Long-tailed Weaver-bird (*Chera progne*). Deposited.
 2 Chinese White-eyes (*Zosterops simplex*). Deposited.

- Feb. 26. 2 Upland Geese (*Bernicla magellanica dispar*), ♂ ♀. Purchased.
27. 2 Upland Geese (*Bernicla magellanica*), ♂ ♀. Purchased.
1 Herring-Gull (*Larus argentatus*). Presented by the Rev. C. A. Berry.
28. 1 Wapiti Deer (*Cervus canadensis*), ♂. Deposited.
1 Red-throated Diver (*Colymbus septentrionalis*). Presented by E. J. Gale, Esq.
6 Grayling (*Thymallus vulgaris*). Presented by Howard L. Cooper, Esq.
6 Grayling (*Thymallus vulgaris*). Presented by — Jukes, Esq.
- Mar. 3. 2 Red-beaked Weaver-birds (*Quelea sanguinirostris*). Presented by Mrs. Hastings.
1 West-African Python (*Python sebae*). Deposited.
4. 2 North-American Turkeys (*Meleagris gallopavo*), ♂ ♀. Purchased.
6 Shore-Larks (*Otocorys alpestris*). Purchased.
6. 1 Snow-Leopard (*Felis uncia*). From Bhootan. Purchased. See P. Z. S. 1891, p. 212.
1 Serval (*Felis serval*), ♀. Presented by D. Wilson, Esq.
1 White Frog (*Rana temporaria*, var.). Presented by W. Hannaford, Esq.
7. 1 Collared Peccary (*Dicotyles tajaçu*), ♀. Purchased.
1 Yellow-footed Rock-Kangaroo (*Petrogale xanthopus*), ♂. Born in the Menagerie.
1 Rhesus Monkey (*Macacus rhesus*), ♂. Deposited.
9. 1 Passerine Parrakeet (*Psittacula passerina*). Presented by Miss Edith Blanche Burrell.
1 Bennett's Wallaby (*Halmaturus bennetti*), ♀. Deposited.
10. 1 Maguari Stork (*Dissura maguari*). Purchased.
1 Brazilian Teal (*Querquedula brasiliensis*), ♂. Purchased.
12. 1 Striped Hyæna (*Hyæna striata*), ♂. Purchased.
1 Indian Muntjac (*Cervulus muntjac*), ♀. Born in the Menagerie.
1 Indian White Crane (*Grus leucogeranos*). Deposited.
13. 1 Markhoor (*Capra megaceros*), ♂. Received in exchange from the Zoological Gardens, Calcutta.
16. 1 Small-clawed Otter (*Lutra leptonyx*). Purchased. See P. Z. S. 1891, p. 212.
6 Amherst Pheasants (*Thaumalea amherstiae*), 6 ♂. Purchased.
17. 1 Common Otter (*Lutra vulgaris*). Presented by G. C. Edwards-Ker, Esq.
1 Common Rhea (*Rhea americana*). Presented by Mrs. Hatfield.
2 Leopard Tortoises (*Testudo pardalis*). From the Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
5 Angulated Tortoises (*Chersina angulata*). From the Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
1 Tuberculated Tortoise (*Homopus femoralis*). From the Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
4 Arcolated Tortoises (*Homopus arcolutus*). From the Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
1 Hygian Snake (*Elaps hygiee*). From the Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
4 Smooth Clawed-Frogs (*Xenopus laevis*). From the Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.

- Mar. 17. 1 Square-marked Toad (*Bufo regularis*). From the Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
18. 1 Lhuys's Impeyan Pheasant (*Lophophorus lhuysi*), ♂. Purchased. From Szechuen, China. See P. Z. S. 1891, p. 212.
19. 1 Ruddy Sheldrake (*Tudorna casarca*), ♀. Purchased.
20. 1 Brazilian Caracara (*Polyborus brasiliensis*). Presented by J. D. Spooner, Esq.
21. 2 White-throated Capuchins (*Cebus hypoleucos*), 2 ♂. Purchased.
- 1 Coquerel's Lemur (*Cheirogaleus coquereli*), ♀. Purchased.
- 1 Collared Peccary (*Dicotyles tajacu*), ♂. Purchased.
- 2 Griffon Vultures (*Gyps fulvus*). Purchased.
- 1 Green-cheeked Amazon (*Chrysotis viridigenalis*). Presented by Miss Julia Crooke.
23. 1 Purple-faced Monkey (*Semnopithecus leucopymnus*). Presented by Mrs. Sutton Sams.
- 1 Black-headed Lemur (*Lemur brunneus*). Born in the Menagerie.
24. 1 Sooty Mangabey (*Cercocebus fuliginosus*), ♂. Presented by Miss Kathleen Hill.
- 1 India Civet (*Viverricula malaccensis*). Presented by Col. A. Bloomfield.
- 2 Malabar Squirrels (*Sciurus maximus*). Presented by Col. A. Bloomfield.
- 1 Laughing Kingfisher (*Dacelo gigantea*). Presented by Chas. C. Barton, Esq.
26. 5 Summer Ducks (*Æx sponsa*), 5 ♀. Purchased.
- 4 Gadwalls (*Chaulelasmus streperus*), 2 ♂, 2 ♀. Purchased.
28. 1 Two-spotted Paradoxure (*Nandinia binotata*). Presented by Dr. J. Galbraith Westlake.
30. 2 Violaceous Plantain Cutters (*Musophaga violacea*). Purchased.
- 1 Carpet-Snake (*Morelia variegata*). Purchased.
31. 1 Arctic Fox (*Canis lagopus*), ♀. Presented by H. Sacheverel Bateman, Esq.
- April 1. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Deposited.
3. 1 Squirrel-like Phalanger (*Belideus sciureus*), ♂. Presented by Mrs. Fitz-Gerald.
- 1 Vulpine Phalanger (*Phalangista vulpina*), ♀. Born in the Menagerie.
- 1 Collared Fruit-Bat (*Cynonycteris collaris*). Born in the Menagerie.
- 4 Cape Colies (*Colius capensis*). Purchased.
- 1 Lacertine Snake (*Cælopeltis lacertina*). Presented by J. C. Warburg, Esq.
4. 1 Common Wolf (*Canis lupus*), ♀. Deposited.
6. 1 Spiny-tailed Mastigure (*Uromastix acanthinurus*). Presented by Mr. W. Williams.
- 3 Puff-Adders (*Vipera arietans*). From the Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
- 3 Egyptian Cobras (*Naia haje*). From the Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
7. 3 Partridge Bronze-wing Pigeons (*Geophaps scripta*). Purchased.
- 3 Maned Geese (*Bernicla jubata*). Purchased.
- 1 Tuatera Lizard (*Sphenodon punctatus*). Presented by Thos. E. Phillips, Esq.

- April 7. 1 Red-spotted Lizard (*Eremias rubro-punctatus*). Presented by Dr. Drewell.
 1 Brush Bronze-wing Pigeon (*Phaps elegans*). Purchased.
 2 Scorpions (*Scorpio*, sp. inc.). Presented by Sidney H. Carver, Esq.
8. 2 Chipping Squirrels (*Tamias striatus*). Presented by Mr. A. W. Jutson.
 2 Indian Pied Hornbills (*Anthracoceros malabaricus*). Purchased.
10. 1 Brown Milvago (*Milvago chimango*). Presented by J. Mand, Esq.
13. 2 Suricates (*Suricata tetradactyla*). Presented by J. W. Munt, Esq.
14. 2 Azara's Opossums (*Didelphys azaræ*), ♂ ♀. Presented by Edward C. Hawes, Esq.
15. 1 Lesser Orang (*Simia morio*), ♂. Presented by Commander Ernest Rason, R.N. From Sarawak, Borneo. See P. Z. S. 1891, p. 301.
 1 Lion (*Felis leo*), ♀. Purchased.
16. 1 Grey Parrot (*Psittacus erithacus*). Deposited.
17. 1 Nylghaie (*Boselaphus tragocamelus*), ♂. Purchased.
20. 1 Sooty Mangabey (*Cercocebus fuliginosus*), ♂. Presented by F. J. Bennett, Esq.
 1 Egyptian Cat (*Felis chaus*). Purchased.
 2 Mace's Sea-Eagles (*Haliaeetus leucorhynchus*). Purchased.
 1 Common Night-Heron (*Nycticorax griseus*). Purchased.
 1 Great-billed Tern (*Phaethusa magnirostris*). Purchased. See P. Z. S. 1891, p. 301.
21. 1 Azara's Agouti (*Dasyprocta azaræ*), ♂. Purchased.
22. 1 Vulpine Phalanger (*Phalangista vulpina*), ♂. Born in the Menagerie.
23. 1 Brown Howler (*Mycetes fuscus*), ♂. Presented by E. Luxmore Marshall, Esq.
 2 Wild Swine (*Sus scrofa*, jr.). Presented by Alex. Williams, Esq.
 1 Black-footed Penguin (*Spheniscus demersus*). Presented by H. B. Bingham, Esq., F.Z.S.
 1 Rock-hopper Penguin (*Eudyptes chrysocome*). Presented by H. B. Bingham, Esq., F.Z.S.
24. 3 Ring-necked Parrakeets (*Palæornis torquatus*), 1 ♂, 2 ♀. Presented by Miss E. Ogilvie.
25. 1 Common Fox (*Canis vulpes*). Deposited.
 2 White Pelicans (*Pelecanus onocrotalus*). Presented by Miss Dolly Bason.
 1 Common Barn-Owl (*Strix flammea*). Presented by H. Bendelack Hewetson, Esq.
 1 Defenceless Lizard (*Agama inermis*). Presented by Gerald Graham-Clarke, Esq.
27. 2 Rooks (*Corvus frugilegus*). Purchased.
28. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mrs. Emily Palmer.
 2 Tasmanian Wolves (*Thylacinus cynocephalus*), ♂ ♀. Received in exchange.
 3 Ursine Dasyures (*Dasyurus ursinus*), 1 ♂, 2 ♀. Purchased.
 4 Australian Wild Ducks (*Anas superciliosus*), 2 ♂, 2 ♀. Purchased.
 2 Brush-Turkeys (*Talegalla lathamii*), ♂ ♀. Purchased.

- April 29. 1 Common Viper (*Vipera berus*). Presented by R. M. J. Teil, Esq.
 1 European Tree-Frog (*Hyla arborea*). Presented by — Barclay, Esq.
30. 1 Black Lemur (*Lemur macaco*). Born in the Menagerie.
 2 Persian Gazelles (*Gazella subgutturosa*), ♂ ♀. Born in the Menagerie.
 2 Herring-Gulls (*Larus argentatus*). Presented by Mrs. Attenborough.
 1 Pine-Grosbeak (*Pinicola enucleator*), ♂. Presented by W. H. St. Quintin, Esq.
- May 1. 1 Bennett's Wallaby (*Halmaturus bennetti*), ♂. Deposited.
 2. 1 Sky-Lark (*Alauda arvensis*). Presented by B. Michael Smith, Esq., F.Z.S.
 1 Shore-Lark (*Otocorys alpestris*). Presented by B. Michael Smith, Esq., F.Z.S.
 1 Goldfinch (*Carduelis elegans*). Presented by B. Michael Smith, Esq., F.Z.S.
 2 Diamond Snakes (*Morelia spilotes*). Deposited.
 2 Brazilian Caracaras (*Polyborus brasiliensis*). Presented by F. E. Cobb, Esq., C.M.Z.S. From Tierra del Fuego.
 1 Turkey Buzzard (*Cathartes aura*). From the Falkland Islands. Presented by F. E. Cobb, Esq., C.M.Z.S.
5. 1 Pig-tailed Monkey (*Macacus nemestrinus*), ♀. Presented by E. Powell, Esq.
 2 Cheer Pheasants (*Phasianus wallichii*), ♂ ♀. Purchased.
6. 12 Common Teal (*Querquedula crecca*), 4 ♂, 8 ♀. Purchased.
 1 Viscacha (*Lagostomus trichodactylus*). Born in the Menagerie.
8. 2 Brown Capuchins (*Cebus fatuellus?*), 2 ♂. Presented by James Meldrum, Esq.
 1 Ocelot (*Felis pardalis*). Presented by James Meldrum, Esq.
 1 Coypu (*Myopotamus coypus*), ♂. Presented by James Meldrum, Esq.
 2 Ring-tailed Coatis (*Nasua rufa*), ♀. Presented by James Meldrum, Esq.
 2 Cayenne Lapwings (*Vanellus cayennensis*). Presented by James Meldrum, Esq.
 7 Burrowing Owls (*Speotyto cunicularia*). Presented by James Meldrum, Esq.
 1 Common Hare (*Lepus europæus*). Presented by Mr. H. J. Bowes.
 1 Red Kangaroo (*Macropus rufus*), ♂. Born in the Menagerie.
9. 3 Pintail (*Dafila acuta*), 2 ♂, 1 ♀. Presented by G. F. Mathews, Esq., R.N., F.Z.S.
 1 Mandarin Duck (*Æx galericulata*), ♀. Presented by G. F. Mathews, Esq., R.N., F.Z.S.
 1 Common Boa (*Boa constrictor*). Presented by the Demerara Museum.
12. 2 Swinhoe's Pheasants (*Euplocamus swinhoii*), ♂ ♀. Purchased.
 2 Japanese Pheasants (*Phasianus versicolor*), 2 ♀. Purchased.
 2 Amherst Pheasants (*Thaumalea amherstiae*), 2 ♀. Purchased.
 2 Brent Geese (*Bernicla brenta*). Presented by Mrs. Atkinson.
 1 Pintail (*Dafila acuta*), ♂. Presented by Mrs. Atkinson.
 2 Wigeon (*Mareca penelope*), ♂ ♀. Presented by Mrs. Atkinson.

- May 12. 1 Common Sheldrake (*Tadorna vulpanser*), ♀. Presented by Mrs. Atkinson.
 2 Golden Tench (*Tinca vulgaris*, var.). Presented by Mrs. Atkinson.
 9 Golden Carp (*Carassius auratus*). Presented by Mrs. Atkinson.
 1 European Tree-Frog (*Hyla arborea*). Presented by Miss Wright.
13. 1 Crested Porcupine (*Hystrix cristata*). Deposited.
 14. 2 Indian Desert-Foxes (*Canis leucopus*). Born in the Menagerie.
 1 Tibetan Crossoptilon (*Crossoptilon tibetanum*), ♀. Purchased. From Szechuen, China.
 1 Black-necked Stilt Plover (*Himantopus nigricollis*). Purchased.
 1 Cayenne Lapwing (*Vanellus cayennensis*). Purchased.
 1 Wild Swine (*Sus scrofa*), ♀. Received in Exchange. From Persia.
15. 8 European Tree-Frogs (*Hyla arborea*). Presented by Clifford D. Fothergill, Esq.
 1 Striped Hyæna (*Hyæna striata*), ♀. From Karachi. Presented by B. T. Finch, Esq., C.M.Z.S.
16. 2 Golden Agoutis (*Dasyprocta aguti*). Presented by H. Barringer, Esq.
18. 1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.
 1 Capybara (*Hydrochaeris capybara*), ♀. Purchased.
19. 1 Japanese Deer (*Cervus sika*), ♀. Born in the Menagerie.
20. 1 Common Rhea (*Rhea americana*). Presented by R. P. Houston, Esq.
 2 Variegated Sheldrakes (*Tadorna variegata*), ♂ ♀. Purchased.
 4 Crested Screamers (*Chauna chavaria*). Presented by the Duke of Newcastle.
 2 Larger Tree-Ducks (*Dendrocygna major*). Purchased.
21. 1 Barbary Ape (*Macacus inuus*), ♂. Presented by the Rev. H. G. Watkins.
 1 Dog (*Canis familiaris*). From New Guinea. Presented by A. McIlwraith, Esq., F.Z.S.
 1 Tree-Boa (*Corallus hortulanus*). From Trinidad. Presented by Messrs. R. R. Mole and Fritz Ulrich.
 1 South-American Rat Snake (*Spilotes variabilis*). From Trinidad. Presented by Messrs. R. R. Mole and Fritz Ulrich.
 1 Carinated Snake (*Herpetodryas carinatus*). From Trinidad. Presented by Messrs. R. R. Mole and Fritz Ulrich.
 2 Plica Lizards (*Uraniscodon plica*). From Trinidad. Presented by Messrs. R. R. Mole and Fritz Ulrich.
 1 African Wild Ass (*Equus teniopus*), ♂. Born in the Menagerie.
 2 Blue-bearded Jays (*Cyanocorax cyanopogon*). Deposited.
 1 Brown Chimango (*Milvago chimango*). Deposited.
 1 Violaceous Night-Heron (*Nycticorax violaceus*). Deposited.
22. 1 Moorish Tortoise (*Testudo mauritanica*). Presented by Mrs. Margaret Clarke.
 1 Chinchilla (*Chinchilla lanigera*). Born in the Menagerie.
23. 1 Black-eared Marmoset (*Hapale penicillata*). Presented by Abercy Lace, Esq.
 1 Diuca Finch (*Diuca grisea*). From Chili. Presented by Mrs. Charles G. Sharpe.

- May 23. 2 Gay's Finches (*Phrygilus gayi*). From Chili. Presented by Mrs. Charles G. Sharpe.
- 2 De Filippi's Meadow-Starlings (*Sturnella defilippi*). Presented by Mrs. Charles G. Sharpe.
25. 1 Japanese Deer (*Cervus sika*), ♀. Born in the Menagerie.
26. 1 Water-Buck Antelope (*Cobus ellipsiprymnus*), ♀. Presented by G. S. Mackenzie, Esq., F.Z.S. From Mombasa. See P. Z. S. 1891, p. 326.
- 1 Leopard (*Felis pardus*). Presented by G. S. Mackenzie, Esq., F.Z.S. From Kismayu, E. Africa.
- 2 Vulturine Guinea-fowls (*Numida vulturina*). Presented by G. S. Mackenzie, Esq., F.Z.S. From Kismayu, E. Africa.
- 2 Mitred Guinea-fowls (*Numida mitrata*). From Mombasa. Presented by G. S. Mackenzie, Esq., F.Z.S.
28. 2 Coypu Rats (*Myopotamus coypus*). Purchased.
- 2 Andaman Starlings (*Sturnia andamanensis*). Purchased.
- 2 Red-billed Hornbills (*Toccos erythrorhynchus*). Purchased.
- 2 Snow-Buntings (*Plectrophanes nivalis*). Purchased.
- 2 Red-headed Buntings (*Emberiza luteola*). Purchased.
- 2 African Spoonbills (*Platalea alba*). Purchased.
- 1 Peregrine Falcon (*Falco peregrinus*). Presented by Thos. C. Smith, Esq.
- 1 Red Deer (*Cervus elaphus*), ♂. Born in the Menagerie.
29. 1 Mountain Ka-Ka (*Nestor notabilis*). Presented by Herbert Furber, Esq.
30. 1 Ducorps's Cockatoo (*Cacatua ducorpsi*). Presented by Nicholas O'Reilly, Esq.
- 4 Californian Quails (*Callipepla californica*), 1 ♂, 3 ♀. Presented by Nicholas O'Reilly, Esq.
- 2 Grey Squirrels (*Sciurus griseus*). Presented by Nicholas O'Reilly, Esq.
- 1 Hudson's-Bay Squirrel (*Sciurus hudsonius*). Presented by Nicholas O'Reilly, Esq.
- 3 Blanford's Rats (*Mus blanfordi*). Presented by W. L. Sclater, Esq., F.Z.S. From the Shevaroy Hills, Madras Pres. See P. Z. S. 1891, p. 326.
- 4 Ocellated Terrapins (*Morenia ocellata*). From the Hoogly, India. Presented by W. L. Sclater, Esq., F.Z.S.
- 2 Virginian Eagle Owls (*Bubo virginianus*). Purchased. From the Straits of Magellan.
31. 2 Ravens (*Corvus corax*). Presented by Capt. Ogilby.
- June 2. 1 Collared Fruit-Bat (*Cynonycteris collaris*). Born in the Menagerie.
- 1 Diamond Snake (*Morelia spilotes*). Presented by Mr. T. Hellberg.
3. 2 Senegal Piapecs (*Ptilostomus senegalensis*). Purchased.
- 1 Madeiran Pigeon (*Columba trocaz*). Deposited.
4. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Mr. Walter Fraser.
- 4 North-African Jackals (*Canis anthus*). Born in the Menagerie.
5. 4 Macqueen's Bustards (*Houbara macqueeni*), 2 ♂, 2 ♀. Presented by B. T. Finch, Esq., C.M.Z.S. From Mekran.
- 1 Great Black-headed Gull (*Larus ichthyaetus*). Presented by B. T. Finch, Esq., C.M.Z.S. From the Persian Gulf. See P. Z. S. 1891, p. 464.

- June 5. 3 Chaplain Crows (*Corvus capellanus*). Presented by B. T. Ffinch, Esq., C.M.Z.S.
- 1 Common Viper (*Vipera berus*). Presented by W. H. B. Pain, Esq.
6. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Col. Beresford.
7. 2 Partridge Bronze-wing Pigeons (*Geophaps scripta*). Hatched in the Gardens.
8. 2 Radiated Tortoises (*Testudo radiata*). From Madagascar. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
- 1 Angulated Tortoise (*Chersina angulata*). From the district of Clanwilliam, Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
- 2 Robben Island Snakes (*Coronella phocarum*). From Robben Island. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
- 1 Hoary Snake (*Coronella cana*). From Wynberg, Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
- 3 Purplish Geckos (*Phyllodactylus porphyreus*). From Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
- 1 Smooth-bellied Snake (*Homalosoma lutrix*). From Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
9. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by James B. Leckie, Esq.
- 2 Elliot's Pheasants (*Phasianus ellioti*), 2 ♀. Purchased.
- 2 Rufous Tinamous (*Rhynchotus rufescens*). Purchased.
- 20 Marbled Newts (*Molge marmorata*). Bred in the Menagerie.
10. 1 Ortolan Bunting (*Emberiza hortulana*), ♀. Purchased.
11. 5 Squirrel-like Phalangers (*Belideus sciureus*), 3 ♂, 2 ♀. Deposited.
- 1 Green Lizard (*Lacerta viridis*). Presented by Mrs. Hill.
12. 1 White-fronted Amazon (*Chrysotis leucocephala*). Presented by Mrs. Lacàbra.
13. 1 Angolan Vulture (*Gypohierax angolensis*). Purchased.
- 12 Gallot's Lizards (*Lacerta galloti*). Presented by E. G. Meade-Waldo, Esq., F.Z.S. From Teneriffe.
- 8 Greenish Sand-Skins (*Chalcides viridanus*). From Teneriffe. Presented by E. G. Meade-Waldo, Esq., F.Z.S.
- 1 Delalande's Geckos (*Tarentola delalandii*). From Teneriffe. Presented by E. G. Meade-Waldo, Esq., F.Z.S.
- 4 Scorpions (*Scorpio*, sp. inc.). From Teneriffe. Presented by E. G. Meade-Waldo, Esq., F.Z.S.
- 1 Short-nosed Bandicoot (*Perameles obesula*), ♀. Purchased.
- 1 Grand Eclectus (*Eclectus roratus*). Deposited.
- 3 Horned Lizards (*Phrynosoma cornutum*). Presented by James E. Talmage, Esq.
15. 3 Stoats (*Mustela erminea*). Presented by J. S. B. Borough, Esq.
- 1 Burrhel Wild Sheep (*Ovis burrhel*), ♂. Born in the Menagerie.
- 1 Tawny Eagle (*Aquila naevioides*). From Africa. Presented by K. G. Hay, Esq.
- 2 Chinese Geese (*Anser cygnoides*), ♂ ♀. Presented by Capt. J. W. Creaghe.
- 2 Impeyan Pheasants (*Lophophorus impeyanus*). Bred in the Menagerie.
16. 1 Bennett's Wallaby (*Halmaturus bennetti*), ♂. Born in the Menagerie.

- June 16. 2 Abyssinian Guinea-fowl (*Numida ptilorhyncha*). Deposited.
17. 1 Ocelot (*Felis pardalis*), ♂. Presented by Sir Henry Blake, K.C.M.G.
 1 Red-tailed Buzzard (*Buteo borealis*). Presented by Sir Henry Blake, K.C.M.G.
 1 Laughing Gull (*Larus atricilla*). From the West Indies. Presented by Sir Henry Blake, K.C.M.G.
 2 Heloderms (*Heloderma suspectum*). Deposited.
18. 1 Goat (*Capra*, sp. inc.), ♀. Presented by C. V. Creagh, Esq.
 1 Vinaceous Amazon (*Chrysotis vinacea*). Purchased.
 1 Blue-fronted Amazon (*Chrysotis leucocephala*). Presented by Mrs. A. G. Nussey.
19. 1 Grey-breasted Parrakeet (*Bolborhynchus monachus*). Presented by Mr. J. R. George.
 1 Chinese Goose (*Anser cygnoides*). Presented by J. Wightman, Esq.
 1 Blossom-headed Parrakeet (*Palaeornis cyanocephalus*). Deposited.
 1 Meyer's Parrot (*Papocephalus meyeri*). Deposited.
20. 3 Tibetan Crossoptilons (*Crossoptilon tibetanum*), 2 ♂, 1 ♀. From Western China. Purchased. See P. Z. S. 1891, p. 464.
 1 Temminck's Tragopan (*Cerionis temminckii*), ♂. From Western China. Purchased.
 1 Collar-less Pheasant (*Phasianus decollatus*). From Western China. Purchased.
 4 Common Quails (*Coturnix communis*), 3 ♂, 1 ♀. Presented by J. C. Gie, Esq.
 2 Mule Deer (*Cariacus macrotus*), ♂ ♀. Born in the Menagerie.
22. 1 American Red Fox (*Canis fulvus*). Presented by Mr. W. Reading.
 1 Derbian Wallaby (*Halmaturus derbianus*), ♂. Born in the Menagerie.
 3 Common Night-Herons (*Nycticorax griseus*). Born in the Menagerie.
23. 1 Sinaitic Ibex (*Capra sinaitica*), ♀. Presented by Sir James Anderson. From the Erba Mountains, 120 miles N. of Snakim. See P. Z. S. 1891, p. 464.
 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mr. Albert Job.
24. 1 Two-spotted Paradoxure (*Nandinia binotata*). Presented by E. G. Parkinson, Esq.
 2 White-headed Sea-Eagles (*Haliaeetus leucocephalus*). Received in Exchange.
25. 2 Gaimard's Rat-Kangaroos (*Hypsiprymnus gaimardi*), 2 ♀. Presented by Walter Howker, Esq.
 1 Burchell's Zebra (*Equus burchelli*), ♂. Born in the Menagerie.
26. 1 Cuckoo (*Cuculus canorus*). Presented by V. S. Marks, Esq.
 2 Red-billed Tree-Ducks (*Dendrocygna autumnalis*). Presented by — Keswick, Esq.
 1 Common Viper (*Vipera berus*). Presented by Mr. J. Sargeant.
27. 1 White-faced Tree-Duck (*Dendrocygna viduata*). Presented by Capt. C. A. Findlay, R.N.R., ss. 'Ruapehu.'
30. 1 Duyker-Bok (*Cephalophus mergens*), ♂. Presented by A. Barsdorf, Esq.

- July 1. 1 Orange-cheeked Waxbill (*Estrela melpada*). Presented by Mrs. Harris.
- 1 Zebra Waxbill (*Estrela subflava*). Presented by Mrs. Harris.
- 1 Nutmeg Finch (*Munia punctularia*, var.). Presented by Mrs. Harris.
- 1 Common Viper (*Vipera berus*). Presented by W. H. B. Pain, Esq.
2. 5 West-Indian Agoutis (*Dasyprocta cristata*). Presented by the Board of Guardians of the Institute of Jamaica.
- 1 Spotted Cavy (*Cologenyis paca*). Presented by R. Kirk, Esq.
3. 1 Chimpanzee (*Anthropopithecus troglodytes*), ♂. Presented by Major Al. McDonnell Moore.
- 1 Chattering Lory (*Lorius garrulus*). Presented by Miss Alice Dundas.
- 2 Slow Loris (*Nycticebus tardigradus*). Presented by R. Dickson, Esq.
- 1 Javan Fish-Owl (*Ketupa javanensis*). Presented by R. Dickson, Esq.
- 4 Grey Parrots (*Psittacus erithacus*). Deposited.
- 1 Thar (*Capra jemlaica*), ♂. Born in the Menagerie.
4. 2 Turtle-Doves (*Turtur communis*). Presented by E. W. H. Blagg, Esq.
- 1 Huanaco (*Lama huanacos*), ♂. Presented by Messrs. J. Fallows and J. D. Wallace. From the Province of Rioja, Argentine Republic.
6. 2 Senegal Touracous (*Corythaix pensa*). Presented by Sir Brandforth Griffith, Bart.
8. 2 Mule Deer (*Cariacus macrotis*), 2 ♂. Born in the Menagerie.
- 2 Rock-Thrushes (*Monticola saxatilis*). Presented by the Rev. Hubert D. Astley.
- 3 Summer Ducks (*Æx sponsa*). Bred in the Menagerie.
- 5 Chilian Pintail (*Dafila spinicauda*). Bred in the Menagerie.
- 7 Mandarin Ducks (*Æx galericulata*). Bred in the Menagerie.
- 2 Australian Wild Ducks (*Anas superciliosa*). Bred in the Menagerie.
- 1 Spotted-billed Duck (*Anas pæcilorhyncha*). Bred in the Menagerie.
9. 1 Macaque Monkey (*Macacus cynomolgus*). Presented by R. Armstrong, Esq.
10. 2 Larger Hill-Mynahs (*Gracula intermedia*). Deposited.
- 1 Half-collared Owl (*Scops semitorques*). Presented by J. de la Touche, Esq.
13. 1 Burrhel Wild Sheep (*Ovis burrhel*), ♂. Born in the Menagerie.
14. 1 Japanese Deer (*Cervus sika*), ♀. Born in the Menagerie.
15. 2 Ruddy-headed Geese (*Bernicla rubidiceps*), ♂. Presented by F. E. Blaauw, Esq., C.M.Z.S.
16. 2 Night-Herons (*Nycticorax griseus*). Bred in the Menagerie.
- 1 Smooth Snake (*Coronella laevis*). Presented by W. H. B. Pain, Esq.
17. 2 Great Eagle-Owls (*Bubo maximus*). Deposited.
18. 6 Eyed Lizards (*Lacerta ocellata*). Purchased.
- 2 Four-lined Snakes (*Cobuber quadrilineatus leopardinus*). Purchased.
- 1 Back-marked Snake (*Rhinechis scalaris*). Purchased.

- July 19. 1 Bennett's Wallaby (*Halmaturus bennetti*), ♀. Born in the Menagerie.
20. 1 Silver-backed Fox (*Canis chama*), ♂. Presented by Max Michaelis, Esq.
- 2 Pennsylvanian Buzzards (*Buteo pennsylvanicus*). Presented by the Hon. Sir W. Francis Hely-Hutchison, K.C.M.G. From Grenada, W. I.
21. 1 Ring-tailed Coati (*Nasua rufa*). Presented by J. Smalman Smith, Esq.
- 1 Azara's Agouti (*Dasyprocta azaræ*). Purchased.
22. 2 Rough Foxes (*Canis rudis*). From British Guiana. Presented by G. H. Hawtayne, Esq., C.M.Z.S.
- 1 Rough Fox (*Canis rudis*). From British Guiana. Presented by Capt. Arnot.
- 1 Tigrine Cat (*Felis tigrina*). Deposited.
- 1 Golden Agouti (*Dasyprocta aguti*). From British Guiana. Presented by Capt. Arnot.
- 2 Spotted Cavies (*Ceologenys paca*). From British Guiana. Presented by Capt. Arnot.
- 1 Crab-eating Opossum (*Didelphys cancrivora*). Deposited.
- 1 Blue-and-Yellow Macaw (*Ara ararauna*). Deposited.
- 1 Red-and-Yellow Macaw (*Ara chloroptera*). Deposited.
- 2 Orange-winged Amazons (*Chrysotis amazonica*). Deposited.
- 1 Yellow-fronted Amazon (*Chrysotis ochrocephala*). Deposited.
- 1 Hawk-headed Parrot (*Deropterus accipitrinus*). Deposited.
- 1 Common Trumpeter (*Psophia crepitans*). Deposited.
- 2 West-Indian Rails (*Aramides cayemensis*). From British Guiana. Presented by Capt. Arnot.
- 1 Martinique Gallinule (*Ionornis martinicus*). Deposited.
23. 1 White-lipped Peccary (*Dicotyles labiatus*). Deposited.
- 2 Common Goats (*Capra hircus*). Deposited.
- 3 Crested Curassows (*Crax alector*). From British Guiana. Presented by Capt. Arnot.
24. 1 Barn-Owl (*Strix flammea*). Presented by E. Hart, Esq., F.Z.S.
- 1 White-fronted Capuchin (*Cebus albifrons*). Presented by the Earl of Carnarvon.
26. 1 Macaque Monkey (*Macacus cynomolgus*). Presented by Mr. G. Stevenson Macfarlane.
27. 1 Laughing Kingfisher (*Dacelo gigantea*). Deposited.
28. 2 Nilotic Crocodiles (*Crocodilus vulgaris*). Presented by Dr. Lester.
- 1 Pleurodele Newt (*Molge walti*). Presented by Miss C. C. Hopley.
29. 1 Banded Ichneumon (*Herpestes fasciatus*). Presented by Dr. Arthur Williams.
30. 2 King Parrakeets (*Aprosmictus scapulatus*). Purchased.
- 2 Black Storks (*Ciconia nigra*). Purchased.
- 1 Black Stork (*Ciconia nigra*). Presented by Lord Lilford, F.Z.S.
- Aug. 1. 1 Cuckoo (*Cuculus canorus*). Presented by Master R. Small.
3. 2 Slowworms (*Anguis fragilis*). Presented by Messrs. F. East and E. Johnson.
- 1 Lesser Sulphur-crested Cockatoo (*Cacatua sulphurea*). Presented by Miss Partridge.
5. 1 Grey Parrot (*Psittacus erithacus*). Deposited.

- Aug. 5. 2 Grey Ichneumons (*Herpestes griseus*). Presented by H. E. Lindsay, Esq.
- 2 Golden Paradoxures (*Paradoxurus zeylanicus*). Presented by H. E. Lindsay, Esq.
- 1 Indian Cobra (*Naja tripudians*). Presented by H. E. Lindsay Esq.
- 1 Agile Wallaby (*Halmaturus agilis*). Presented by G. Skelton Streeter, Esq.
6. 2 Barbary Turtle-Doves (*Turtur risorius*). Presented by Miss Dolly Bason.
- 3 Grey Parrots (*Psittacus erithacus*). Deposited.
- 2 Harnessed Antelopes (*Tragelaphus scriptus*), ♂ ♀. Presented by R. B. Llewelyn, Esq., C.M.G.
7. 1 Egyptian Gazelle (*Gazella dorcas*), ♀. Presented by Capt. S. C. Saunders. From Tunis.
- 1 Ring-tailed Coati (*Nasua rufa*). Presented by Edward J. Brown, Esq.
- 2 Herring-Gulls (*Larus argentatus*). Presented by T. A. Cotton, Esq.
8. 2 White-bellied Sea-Eagles (*Haliaeetus leucogaster*). Presented by Hugh Nevill, Esq., F.Z.S.
10. 1 Common Otter (*Lutra vulgaris*), ♀. Presented by D. E. Cardinall, Esq.
- 1 Marbled Polecat (*Putorius sarmaticus*). Presented by Col. C. Shepherd. From Quetta, Beluchistan.
- 1 Golden Eagle (*Aquila chrysaetus*). From the Atlas. Presented by Capt. Taylor.
11. 1 Vulpine Squirrel (*Sciurus vulpinus*). Presented by Miss Pickford.
- 7 Lemmings (*Myodes lemmus*). From Norway. Presented by T. T. Somerville, Esq.
- 2 Sparrow-Hawks (*Accipiter nisus*). Presented by Digby S. W. Nicholl, Esq., F.Z.S.
- 3 Japanese Green Finches (*Fringilla kawarabibi*). Presented by F. E. Blaauw, Esq., C.M.Z.S.
12. 1 Brown Capuchin (*Cebus fatuellus*), ♀. Presented by Miss Phyllis Duncan.
- 1 Yak (*Poëphagus grunniens*), ♀. Born in the Menagerie.
13. 10 Andalusian Short-toed Larks (*Calandrella bætica*). Deposited.
- 1 Common Chameleon (*Chamæleon vulgaris*). Presented by Capt. Wood.
- 1 Dwarf Chameleon (*Chamæleon pumilis*). Presented by Capt. Wood.
- 2 Common Chameleons (*Chamæleon vulgaris*). Presented by E. Palmer, Esq.
14. 2 Undulated Grass-Parrakeets (*Melopsittacus undulatus*). Received in Exchange.
- 1 West-Indian Agouti (*Dasyprocta cristata*). From Trinidad. Presented by R. J. L. Guppy, Esq., C.M.Z.S.
- 1 Golden Agouti (*Dasyprocta aguti*). From Trinidad. Presented by R. J. L. Guppy, Esq., C.M.Z.S.
- 2 Violet Tanagers (*Euphonia violacea*), ♂ ♀. Presented by R. J. L. Guppy, Esq., C.M.Z.S.
- 1 Red-bellied Squirrel (*Sciurus variegatus*). Presented by R. J. L. Guppy, Esq., C.M.Z.S.
- 1 Egyptian Ichneumon (*Herpestes ichneumon*). Deposited.

- Aug. 15. 1 Grey Parrot (*Psittacus erythacus*). Presented by Mrs. Hale.
17. 4 Leopard Tortoises (*Testudo pardalis*). From the Cape. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
- 3 Angulated Tortoises (*Chersina angulata*). From the Cape. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
- 1 Galeated Pentonyx (*Pelomedusa galeata*). From the Cape. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
- 1 Hoary Snake (*Coronella cana*). From the Cape. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
- 1 Robben-Island Snake (*Coronella phocarum*). From the Cape. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
- 2 Water-Vipers (*Cenchris piscivora*). Deposited.
19. 5 White-eared Conures (*Conurus leucotis*). Presented by Mrs. Arthur Smithers.
20. 1 Common Fox (*Canis vulpes*). Presented by Capt. H. S. Tunnard.
21. 1 Gold Pheasant (*Thaumalea picta*), ♀. Presented by R. Hudson, Esq.
- 2 Alligators (*Alligator mississippiensis*). Presented by Charles Downs, Esq.
- 1 Pig-tailed Monkey (*Macacus nemestrinus*), ♂. Deposited.
22. 1 Grey Lemur (*Hapalemur griseus*). Purchased.
24. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Mr. H. Wother.
- 1 Pinche Monkey (*Midas ædipus*), ♂. Presented by Mr. H. Wother.
- 1 Greater Sulphur-crested Cockatoo (*Cacatua galerita*). Deposited.
25. 1 Smooth Snake (*Coronella lævis*). Presented by F. C. Adams, Esq.
- 1 Roseate Cockatoo (*Cacatua roseicapilla*). Presented by Mrs. Amy Jones, F.Z.S.
27. 1 Punctured Salamander (*Amblystoma punctatum*). Presented by J. H. Thomson, Esq., Ph.D.
28. 1 Thick-necked Tree-Boa (*Epicrates cenchris*). From Trinidad. Presented by Messrs. R. R. Mole and F. W. Ulrich.
- 1 Marbled Polychrus (*Polychrus marmoratus*). From Trinidad. Presented by Messrs. R. R. Mole and F. W. Ulrich.
29. 1 Slender-billed Cockatoo (*Licmetis tenuirostris*). Presented by Miss Caplen.
30. 1 Black-faced Kangaroo (*Macropus melanops*), ♂. Deposited.
- 1 Grey Parrot (*Psittacus erythacus*). Deposited.
31. 1 Australian Thicknee (*Ædicnemus grillarius*). Presented by Sir Ferdinand von Mueller, K.C.M.G., F.R.S., C.M.Z.S.
- Sept. 3. 2 Many-zoned Hawks (*Melierax polyzonus*). Presented by Capt. Thomas Hay.
- 1 Dorsal Hyrax (*Hyrax dorsalis*). From Sierra Leone. Presented by C. B. Mitford, Esq. See P. Z. S. 1891, p. 465.
- 1 Ring-necked Parrakeet (*Palaornis torquatus*). Presented by Mrs. Bowen.
4. 1 Manx Shearwater (*Puffinus anglorum*). Presented by Master Riviere.
- 1 Common Polecat (*Mustela putorius*). Presented by F. D. Lea Smith, Esq.
7. 1 Fallow Deer (*Dama vulgaris*), ♂. Presented by J. Johnston, Esq.